



15TH

**UNIVERSITY OF LAGOS
ANNUAL RESEARCH CONFERENCE**

**CONFERENCE PROCEEDINGS
& BOOK OF ABSTRACTS**



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EDITORS

O. AKINLEYE

A. SOWEMIMO

A. OKANLAWON

L. CHUKWU

O. FAMILONI

UNIVERSITY OF LAGOS
LAGOS, NIGERIA



15TH UNILAG ANNUAL RESEARCH
CONFERENCE & FAIR
25TH MAY, 2021

CONFERENCE PROCEEDINGS

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PREFACE

The 15th Annual (1st Virtual) University of Lagos Research Conference and Fair with the Theme “**Saving the Earth**” took place at University of Lagos on May 25, 2021.

The sub-themes of the conference are:

- The COVID-19 Pandemic
- Culture, Arts and Creativity
- Evolving Curriculum for Sustainability
- Innovative Management
- Innovation in Science and Technology
- Nature and Health Care
- Legal Issues and Regulatory Frameworks
- Sustainability and Engineering Nexus

The conference was declared open by the Vice-Chancellor of University of Lagos, Prof. Oluwatoyin Temitayo Ogundipe. The year’s conference happened to be the first virtual version of the annual conference, necessitated by the ravaging COVID-19 and the mitigation measures necessary to contain it. The sessions were run out of the Arthur Mbanefo Digital Research Center, University of Lagos, Akoka.

The conference had over 200 participants which include academia from various universities within and outside Nigeria. The keynote address was delivered by Chief Dr (Mrs) Nike Akande, former Minister of Industry, Federal Republic of Nigeria and former President, Lagos Chamber of Commerce and Industries. Dr Reuben Bamidele, the National Programme Office UNIDO also delivered a paper at the plenary session.

A total number of 9 oral paper presentations and 150 poster presentations were made during the conference. The deliberations at the conference led to the following observations:

- Environment is principally the basic essential system that sustains the existence of all life forms on planet earth and the natural atmosphere is now being polluted due to man-driven and natural factors. And some of the major problems in our environment are, but not limited to air pollution, water pollution, climate change, biodiversity loss, soil degradation and deforestation which exacerbates desertification in many regions of Africa including Nigeria.
- Climate change is the biggest environment threat to global sustainable development. In Nigeria, climate change poses severe risk to agricultural development and food security, and the impact is expected to be brutal on the Nigerian economy considering the strategic importance of agriculture to economic output and employment.

- The manufacturing sector suffers from the effects of climate change as it represents one-fifth of domestic direct emissions. And the emergence of coronavirus (COVID-19) pandemic had a serious impact on all the sectors of the economy worldwide. The impact was much felt in the educational sector. It has necessitated the need for extraordinary solutions and alternative for teaching and learning in Nigeria's tertiary institutions.
- E-learning as a paradigm in developing information and communication technologies has established entirely new conditions for the handling of information in the education system.
- Practices such as deforestation, agriculture and infrastructural development alter land cover and can also compromise the hydrological balance of the natural environment.
- The present state of Vocational and Technical Education in Nigeria is below acceptable standard due to the reduced emphasis on apprenticeship training method, inadequate involvement of organised private sectors in vocational/technical education and training
- Industries extract raw materials from the environment, at a rate faster than it can be replenished, and often pollute the environment during exploitation and processing of these raw materials.

Flowing from these observations the conference made the following recommendations:

- Governments need to enact and implement policies to drastically reduce greenhouse gas (GHG) emissions. Further, businesses have to realise that a carbon constrained future is imminent and have to embed into their strategies the needed protocols to mitigate the effects of climate change.
- Farmers globally, especially those in developing economies such as Nigeria, need to adopt sustainable land management practices such as agroforestry where trees are integrated with crops, animals, or both to provide shade and natural fertilization combined with conservative agriculture methods.
- The country needs to move away from fossil fuels to adopt environmentally-friendly renewable energies such as solar, wind, biomass and geothermal.
- Government should collaborate with trainers in the use of e-learning programme to get the stakeholders in the educational system better equipped to meet the expected standard in the dissemination of online teaching.
- Sustainable conservation practices and good land cover management policies be established to safeguard the river basins in Nigeria.
- Institutions and the policy formulation process should be strengthened to enhance effective policy implementation and fast track economic growth and diversification processes in Nigeria.

Prof. Abayomi Okanlawon
Chairman, Conference Planning Committee

HUMANITIES

**PSYCHOSOCIAL EFFECTS OF ONLINE TEACHING ON SOME SELECTED
SECONDARY SCHOOL STUDENTS DURING THE COVID-19 PANDEMIC
LOCKDOWN IN LAGOS METROPOLIS, NIGERIA.**

***Adebiyi D.T., Makinde B.O. and Olusakin A.M.**

Department of Educational Foundations

Faculty of Education

University of Lagos, Nigeria

*adebiyideborah@yahoo.com; dadebiyi@unilag.edu.ng

ABSTRACT

In recent times, the need to engage secondary school students during the total lockdown in almost all nations of the world has called for an emergence of online teaching in Lagos metropolis. This study investigates the psychosocial effects of online teaching on some selected secondary school students during the COVID-19 pandemic lockdown in Lagos Metropolis, Nigeria. The population comprised 300 students (160 boys and 140 girls) selected through self-developed online questionnaires. Two hypotheses tested at 0.05 level of significance were raised to guide the conduct of the study. The data collected were carefully tested using independent t-test. Findings revealed the psychosocial effects of online teaching on secondary school students; most of the respondents agreed not to have access to any gadget that could aid their e-learning. Respondents experienced epileptic power supply, poor internet services which hindered their accessibility to online teaching; they were also not familiar with some of the digital education tools used in e-learning such as edmodo, projeqt, TED-Ed, socrative among others. Furthermore, it revealed that there is no significant difference in the assessment of online gadget, skills, readiness and fear of uncertainty between male and female secondary school students. Based on the findings, suggestions and recommendations are made.

Keywords: effects, gender, psychosocial, COVID-19, students

Introduction

The emergence of coronavirus (COVID-19) pandemic was with a serious impact on all the sectors of the economy worldwide. This impact was much felt in the educational sector, an embodiment of human capital formation. In an attempt to contain the spread of this pandemic, there was a nationwide lockdown. According to UNESCO (2020) the nationwide closures have affected over 70% of the students in the world. Furthermore, the pandemic, alongside social distancing measures has served as a major interference to daily schedules. Academic programs and activities have been on hold in 188 countries. This gives an estimate of 1.5 billion young individuals worldwide who are not in school because of the lockdown. The spread of COVID-19 has brought a great disruption to students' education worldwide such that the educational sector had not experienced in generations (UNESCO, 2020).

Despite the unprecedented lockdown, proactive efforts were being made to ensure a continuity of the teaching and learning process. It is crucial and expedient that learning continues regardless of the anxiety and uncertainty, even if it cannot be traditional face-to-face. Consequently, the psychosocial effects of online teaching on students call for attention; since psychosocial health is seen as a state of mental, emotional, social, and spiritual well-being.

Psychosocial impact is defined as the effect caused by environmental and biological factors on individual's social and psychological aspects of life. During a serious pandemic like COVID-19, community-based relief programs, for example, shutting of schools, parks, and playground will disturb youngsters' typical way of life and can conceivably advance pain and disarray. Both youthful and more established youngsters are probably going to turn out to be all the more requesting, adapting up to these changes, and may show fretfulness, irritation and threatening vibe, which thus may make them conceivably even endure physical and mental violence by excessively pressurized parents and guardians. Stressors, such as, dullness, dissatisfaction, absence of face- to-face contact with schoolmates, companions and educators, absence of enough space at home, and family money related misfortunes during lockdowns, all can possibly trigger inconvenient and even draw out adverse mental results in children. The interaction between their every day schedule changes, home confinement, and dread of contamination could additionally strengthen these unfortunate mental responses bringing about an endless loop (Wang et al., 2020).

Director General of the World Health Organization (WHO) declared the outbreak of the coronavirus disease 2019 (COVID-19) on the 30th January 2020, a Public Health Emergency of International Concern (PHEIC). The pandemic has caused a disruption in educational system as a result of the school closure in order to ensure safety. Given the suddenness of this crisis and its impact on the educational system; it clearly appears that response is a matter of urgency.

This has led to an advent of online teaching and learning. Teaching is carried out digitally, in a remote form with an increasing frequency of students skipping classes, and evading assignments amongst others. Over 1.2 billion children in about 186 countries of the world are involved in school closure. This implies closure of all activities including sport competition that boosts the morale of all. The learner-teacher physical attachment is also severed.

Online teaching is not free from its challenges-psychosocial adjustment, mental health, internet issues and financial problem among others. While online classes and assignments have been the main effective way for proceeding with teaching at this period, specialists have advised against being over-troubled. Explicit psychosocial needs, sound ways of life, proper hygiene advice, and good child-rearing guides can as well be addressed through online training (Wang et al., 2020).

It is of no doubt that virtually all the nations of the world are faced with varying degrees of unpleasant issues due to the coronavirus (COVID-19). The closure of schools affects about 46million students throughout the country. Therefore, the need for an urgent response across the

educational sector as birthed by the pandemic and the psychosocial effects that could accompany such cannot be overemphasized. There was a clarion call for alternative to traditional interaction otherwise known as face-to-face teaching and learning, since, the role of education to total growth and development of a nation cannot be underestimated. This therefore brought about an advent of e-learning otherwise known as online teaching which is a type of “distance learning educational system” – any learning that takes place outside the traditional classroom setting across distance.

The Nigerian Government among other things through “the Federal Ministry of Education (FME) and the Universal Basic Education Commission (UBEC) have set up a separate Task Team responsible for a coordinated education response to the COVID-19 pandemic. The aim of the task team is to provide guidance, information, and resources to support students across the 36 States of Nigeria including the Federal Capital Territory to continue their education and individualize their learning at home. The task force has a dedicated webpage within the FME’s website and aims to provide real-time guidance on learning resources and support for monitoring children at home. Towards this, the Task Team has developed a ‘Learn at Home Programme’ (LHP). The webpage is constantly updated to reflect the status of implementation of the LHP; online resources and options available for equity in teaching and learning; advice on channels that may be used by states; and systems for tracking and monitoring resources made available for this purpose. FME and UBEC in collaboration with National and State governments aim to provide context-appropriate resources that allow students, teachers, and schools to capitalise on home-based learning. These resources may include homework assignments, reading material, Radio, television, online content, and online learning” (World Bank, 2020).

E-learning as a paradigm in developing information and communication technologies has established entirely new conditions for the handling of information in the education system. Distance education is dedicated to the creation of favourable conditions for students acquiring knowledge corresponding to their chosen profession for the development and manifestation of creative individuality, moral and intellectual qualities. According to (Katz, 2002 in Yazdi and Zandkarimi, 2013). Online teaching as a paradigm of modern education that fulfils the learning requirements necessary for the development of businesses and educational institutions is the use of telecommunication technology. A tool for an effective delivery of information, relevant to education and training. This enhances the use of asynchronous and synchronous learning network models to promote teachers - learners’ interaction as well as learners- learners’ interaction. Recently, online teaching has been of great importance to the educational system especially during this school closure as a result of COVID-19 pandemic to make learning process easy.

E-learning includes the activities that involve the use of various technologies like palm-held computers, internet and cable T.V among others usually in form of web-based learning, virtual learning, distance learning and many others like e-library, e-book, e-assignment, e-dictionary, e-assessment, e-management and e-classroom among others. Based on the complexity and

diversity of e-learning scholars have decided to describe it in various ways (Huffaker and Calvert, 2003; Mayer, 2003).

The role of e-learning on social network sites cannot be overemphasised in many kinds of educational assessment, particularly as a tool for diagnostic assessment and formative assessment - to check the understanding of concepts and to prevent misconceptions of the course content (Garrison, 2011). Online teaching and learning on social network sites are useful educational instruments implored to encourage students to participate and interact more spontaneously through online academic discussion (Vate-U-Lan and Masouras 2018). Consequently, the user friendliness of social network sites with social media applications and the convenience in accessing a mobile device has made online teaching and learning an attractive option as compared to traditional method of teaching as a means of communication since instructors can observe students' behaviour and comprehension of the study content from the posts and the interactions on the social network site. However, online teaching needs to be comprehensively assessed in order to ensure that it meets the same standard with the traditional classes in quality and quantity (Uvalić-Trumbić and Daniel, 2013).

Statement of problem

The most pronounced health problem that affects the whole world is COVID-19 pandemic in this generation. It is experienced by almost all the countries of the world, with a devastating effect on human race. People have died in their thousands across the globe. A number of actions and measures have been taken by the nations of the world – which includes restrictions of movement, school closure among others – as a necessary measure to contain the pandemic in order to save lives. The emergence of the pandemic has not only affected secondary school students psychologically and sociologically but the introduction of online teaching has significantly exposed them to some psychosocial challenges – they are faced with uncertainty and anxiety since they are not aware who the next victim of the pandemic will be. This has also rendered the big nations of the world impotent. The normal routine has been disrupted; social connection has also been reduced to nothing while the regular school calendar has been tampered with. Quite a number of secondary schools in Lagos metropolis have resulted to online teaching; this also has a great effect on the level of general productivity as a result of sudden halt in almost all the activities of the nations of the world. Children from humble background do not find it easy with e-learning or online teaching techniques. Quite a number of students are temporarily or indeterminately out of school as a result of an indefinite closure of educational institution by the Nigerian government.

In an attempt to contain the spread of the deadly virus “stay at home and stay safe; wash your hands in running water, sanitize your hand regularly” has become the popular slogan (UNESCO, 2020). This scenario constitutes a major challenge to the students, parents, the society as a whole and the educational sector; a custodian of resources meant for human capital formation and development. It is a real war against an invisible soldier, keeping our distance is inevitable; which has led to a sudden advent of online teaching; that is hindered by epileptic power supply, unavailability of android phones, unavailability of computer equipment, unstable internet

services, inadequate skills, unpreparedness on the part of the instructors and the students, distractions from the home front in addition to fear of death and uncertainty among others. This study therefore investigates psychosocial effects on students' COVID-19 induced online learning.

Purpose of the study

The main purpose of this study is to access the psychosocial effect of online teaching on some selected secondary school students during the COVID-19 pandemic lockdown in Lagos metropolis, Nigeria.

Research hypotheses

1. There is no significant difference in the psychosocial effects of secondary school students due to emergence of online teaching during COVID-19 pandemic lockdown in Lagos metropolis, Nigeria.
2. There is no significant gender difference in the psychosocial effects of secondary school students due to emergence of online teaching during COVID-19 pandemic lockdown in Lagos metropolis, Nigeria.

Methodology

Sample

The target population included all the secondary school students in Lagos metropolis in Nigeria. A sample of 300 senior secondary school students (160 boys and 140 girls) were selected through self- developed online questionnaires from selected secondary schools. It was posted on the telegram group, WhatsApp group of some selected secondary schools in Lagos metropolis till the expected number of response was obtained in relation to the purpose of the study.

Instrumentation

To generate relevant data, a self-developed instrument entitled “The psychosocial effects of online teaching on some selected secondary school students during the COVID-19 pandemic lockdown in Lagos metropolis (PEOTSQ)” was used. The instrument is composed of sections A and B respectively. Section A focuses on demographic data of the respondents such as gender, age, class among others while Section B contained 15 items on a rating of 4 points. The statements were structured on a 4-point scale that ranges from Strongly Agree, Agree, Disagree and Strongly Disagree to assess “The psychosocial effects of online teaching on some selected secondary school students during the COVID-19 pandemic lockdown in Lagos metropolis (PEOTSSSQ)” in line with the hypotheses formulated.

Validity of instrument

This was done by giving the questionnaire (IPVMSQ) to experts who made necessary corrections to ensure face and content validity.

Data Collection Procedure

The researcher did the administration of the questionnaire online due to the total lockdown in the state as a result of COVID-19 pandemic and a total of 300 questionnaires were properly filled and usable. Data generated were processed using the Statistical Package for Social Sciences (SPSS).

Method of Data Analysis

Independent t-test applied for data analysis while the tests of significance were performed at the 0.05 level of significance.

Data Analysis and Procedure

The study adopted a descriptive survey research design. This is the most appropriate design for this study in the sense that the design tries to investigate problems in a large or vast area and where there is no need for manipulation of variable under investigation. The population for this study comprised of all the students that had undergone online teaching or e-learning during COVID-19 lockdown in Lagos Metropolis, Lagos State. The face and content validities of the instrument were established by some experts. The analysis was carried out with the use of Statistical Packages for Social Science (SPSS). All statistical analysis was tested at 0.05 level of significance.

Table 1: The psychosocial effects of online teaching on some selected secondary school students during the COVID-19 pandemic lockdown in Lagos Metropolis

Hypothesis 1. There is no significant difference in the psychosocial effects of online teaching on secondary school students during COVID-19 pandemic lockdown in Lagos metropolis, Nigeria.

	Assessment of online gadgets	Mean	Stdev	Remark
1.	Access to any gadget that can aid e-learning	3.42	0.49	Agreed
2.	Epileptic power supply hinders accessibility to online teaching	3.41	0.54	Agreed
3.	Familiarity with the digital education tools	2.81	0.90	Agreed
4.	Internet services	3.29	0.52	Agreed
	Skills			
5.	Communication with online gadgets	2.71	0.93	Agreed
6.	Feeling with new digital languages	2.63	0.90	Agreed

7.	Teachers training on online teaching	3.30	0.46	Agreed
Readiness				
8.	Morale toward online	3.22	0.50	Agreed
9.	Conducive environment for online teaching	3.31	0.61	Agreed
10.	Financial support	2.71	0.69	Agreed
11.	Distraction from other social media handles	1.94	0.87	Disagreed
Fear of Uncertainty				
12.	Anxiety and concentration	3.42	0.49	Agreed
13.	Limited social connection	3.32	0.49	Agreed
14.	Discouragement of the news of death and illness everywhere	3.21	0.66	Agreed
15.	Felt that the world is coming to an end	3.38	0.49	Agreed

As presented in Table 1, most of the students agreed to not having access to any gadget that can aid their e-learning (Mean =3.42>2.50), epileptic power supply hinders their accessibility to online teaching (Mean =3.41>2.50), they are not familiar with some of the digital education tools used in e-learning such as edmodo, projeqt, TED-Ed, socrative (Mean =2.81>2.50) and the effects of poor internet services (Mean =3.29>2.50).

Also, majority of the students reported that they cannot communicate well with any of the online gadgets (Mean =2.71>2.50), they are discouraged because of the new digital languages they are not used to (Mean =2.63>2.50 and that most of the teachers are not well trained in healthy online teaching (Mean =3.30>2.50).

In addition, many of the students agreed that the online teaching is coming suddenly, so their morale is dampened (Mean =3.22>2.50), no conducive environment for them at home during online teaching (Mean =3.31>2.50) and they have poor financial support to buy data (Mean =2.71>2.50). However, most of the students disagreed that they are easily distracted by pop-up messages from other social media handles like WhatsApp, Facebook, Instagram (Mean =1.94>2.50).

Furthermore, many of the students agreed that they are full of anxiety during the period- this reduced their level of concentration (Mean =3.42>2.50), their limited social connection has affected the morale in all ways (Mean =3.32>2.50), that they felt discouraged about living- because of the news of death and illness everywhere (Mean =3.21>2.50) and that they felt that the world is coming to an end (Mean =3.38>2.50).

Hypothesis 2: There is no significant gender difference in the psychosocial effects of secondary school students due to emergence of online teaching during COVID-19 pandemic lockdown in Lagos metropolis, Nigeria.

Table 2: Gender difference in the psychosocial effect of online teaching on secondary school students during COVID-19 pandemic lockdown in Lagos metropolis

				Mean		df	t	P	Remark
	Sex	N	Mean	Stdev	Difference				
Assessment of online gadget	Male	160	13.01	1.51					
	Female	140	12.86	1.56	.15	298	.84	.401	NS
Skills	Male	160	8.63	1.65					
	Female	140	8.66	1.71	-.03	298	-.13	.894	NS
Readiness	Male	160	10.21	1.40					
	Female	140	10.15	1.37	.06	298	.35	.726	NS
Fear of uncertainty	Male	160	13.33	1.35					
	Female	140	13.33	1.33	.00	298	.02	.986	NS

As reported in Table 2, there is no significant difference in the assessment of online gadget ($t=0.84$, $p>0.05$), skills ($t=0.13$, $p>0.05$), readiness ($t=0.35$, $p>0.05$) and fear of uncertainty ($t=0.02$, $p>0.05$) between male and female secondary school students. The hypothesis is therefore accepted.

Summary of findings

As observed from the findings, most of the respondents agreed to not having access to any gadget that can aid their e-learning, they experienced epileptic power supply that hindered their accessibility to online teaching, they were not familiar with some of the digital education tools used in e-learning such as edmodo, project, TED-Ed, socrative and that poor internet services.

Also, majority of the students reported that they could not communicate well with any of the online gadgets; they were discouraged because of the new digital languages they are not used to and that most of the teachers are not well trained in healthy online teaching.

In addition, many of the students agreed that the online teaching is coming suddenly, so their morale is dampened, do not have conducive environment for them at home during online teaching and they have poor financial support to buy data while most of the students disagreed that they are easily distracted by pop-up messages from other social media handles like WhatsApp, Facebook, Instagram (Mean =1.94>2.50).

Furthermore, many of the students agreed that they are full of anxiety during the period- this reduced their level of concentration, their limited social connection has affected the morale in all ways, that they felt discouraged about living- because of the news of death and illness everywhere and that they felt that the world was coming to an end.

There is no significance difference in the assessment of online gadget, skills, readiness and fear of uncertainty, between male and female secondary school students.

Implication for counselling

Online teaching during COVID-19 has reduced multiple risks the secondary school students would have been exposed to if the schools had remained on the traditional (face-to-face) method of teaching. In addition, the progress of human capital formation that is vested in the educational system would have been brought to a halt if e-learning had not been opted for.

Recommendations

The school authorities, parents, guardians, religious leaders, social service providers, governments and other stakeholders must ensure that secondary school students are not left alone during this global lockdown but should take it as a point of duty that the students do not use the opportunity of being on the internet to explore wrong sites such as porn sites, online gambling sites, fraudster sites among others which may mar them. The digital technology companies should be involved in restrictions and control.

The study also recommends that government should collaborate more with trainers in the use of e-learning programme to get the teachers, students and other stakeholders in the educational system more equipped to meet the expected standard in the dissemination of online teaching since online teaching is an option in an emergent need like COVID-19 pandemic school closure. In addition, regular appraisal of e-learning should be carried out to update of knowledge on e-learning.

Online counselling should also be made an integral part of school curriculum in Nigerian secondary schools since more sensitive issues are likely to be elicited other than educational topics if engaged in online psychosocial therapy. Therefore, counsellors should be included in the online teaching curriculum to address the issues on mental health (Adebiyi et al., 2019).

Students should be orientated on the benefits of online teaching and how they can go about it since emergent need (such as unexpected COVID-19 pandemic) may arise that may necessitate the need for an online teaching where physical contact may not be realized for effective teaching and learning process to be achieved.

References

- Evans, D.K. and Miguel, E. (2007). "Orphans and schooling in Africa: A longitudinal analysis." *Demography* 44(1): 35-57.
- Garrison, D.R. (2011). *E-learning in the 21st century: A framework for research and practice*. London: Routledge
- <https://en.unesco.org/covid19/educationresponse>
- <https://en.unesco.org/events/2020-global-education-monitoring-report-global-launch>
- Huffaker, D.A. and Calvert, S.L. (2003). The New science of learning: Active learning, metacognition, and transfer of knowledge in e-learning applications. *Journal of Educational Computing Research*, 29, 325-334.
- Adebiyi, D.T., Makinde, B.O. and Olusakin, A.M. (2019) Perception of Secondary School Students toward Online Counselling: A study of Lagos Mainland Local Government, Lagos Nigeria. A Paper presented at the 14th UNILAG International Research Conference & Fair, 21st -23rd August, 2019.
- Mayer, R.E. (2003). Elements of a science of E-learning. *Journal of Educational Computing Research*, 29, 297-313.
- Uyalic-Trumbic, S. and Daniel, J. (2013). *A guide to quality in online learning. Academic Partnerships*. Accessed 3, May 2020.
- Vate-U-Lan, P. and Masouras, P. (2018). *Thriving social network for communication on elearning: Exploring gender differences in attitudes*. In Proceedings of the first international conference on data science, e-learning and information systems. Ayre Gran Hotel Colón, Madrid, Spain.
- Wang G., Zhang Y., Zhao J., Zhang J. and Jiang F. (2020). Mitigate the effects of home confinement on children during the COVID-19 outbreak. *Lancet*; 395:945–947.
- World Health Organisation (2020). *COVID-19 Virtual Press conference 18 March, 2020*.
- World Health Organisation (2020b). *Mental health and psychosocial considerations during the COVID-19 outbreak*.
- Yazdi, S.M. and Zandkarimi, G. (2013). The Impact of E-Learning on some Psychological Dimensions and Academic Achievement. *International Journal of Education and Learning* Vol.2, (2), 49-56 <http://dx.doi.org/10.14257/ijel>.

INDIGENOUS SYSTEM OF YOUTHS HEALTH PRESERVATION: A COMPARATIVE STUDY OF YORÙBÁ RURAL AND MEGA CITY SOCIETY

Oyèwálé Ayòdéle Solomon

Department of Linguistics, African & Asian Studies

University of Lagos, Àkòkà, Lagos

ayoako2002@yahoo.co.uk

ABSTRACT

A life-threatening phenomenon prominent among contemporary youths who are potential future generation and leaders is the battle with various health issues today. Observably, the health challenges peculiar to adults in the past like: obesity (ara-sísanjù), diabetics (ìtò-şùgà), high blood pressure (èjè ríru) etc are now common among the youths in the contemporary Yorùbá society. The objective of this paper is to investigate the factors responsible for health challenges among the youths and the resultant dissatisfied life which many have been struggling to cope with for ages. The methodology adopted for this study is a random investigation through In-depth Interview (II) with twenty (20) respondents, ten males and ten females in respect to life style of youths in typical rural Yorùbá setting in comparison with the modern Yorùbá using Lagos as a case study. In this paper, it is established through the purposive interview conducted with our respondents and eight (8) medical practitioners that the increased population in the city of Lagos has necessitated the need for “adaptation” to the mega city life by most youths. Consequently, the chain reactions of working against human nature and health principles are aggravating health hazards and are exposing most youths to health risks and short life span which are not common in the rural or semi-urban settings in the Yorùbá society. This calls for the need to look inward on youths’ health-related challenges and be more proactive about medical health principles and indigenous healthcare delivery system peculiar to Yorùbá rural setting, as a case study in Nigeria. Besides, circumstances which make the people being referred to as “local” (ará ilú òkè) or rural, to have good immune system, healthiness, longevity, sustained physique and required strength for daily activity for livelihood should be adopted by the modern Yorùbá society.

Keywords: Life-Threatening, Health Principles, Human Nature, Life Span, Health Hazards.

1.0 Introduction

The truism of the saying that “health is wealth,” could never be disproved by any philosophical argument, no matter how logical it seems. A number of scholars like: Orímóògùnjé (2004),

Ajíkòbí (2013), Oyèwálé (2019), Òṣòbà & Òṣó (2016) have explored the subject matter of health from various perspectives, but there is a dearth of work on health as it affects youths in two different geographical locations in the Yorùbá society. This paper attempts to fill this significant gap through a comparative study within the context of Yorùbá rural and urban areas as far as herbal medicine and orthodox medicine is concerned. Quoting Adekson (2003) and Adébólá (2015:304) asserts that: “Yorùbá traditional healers are very unique and they are quite different from orthodox medical practitioners. These traditional healers perform the roles of medical practitioners, psychiatrists, pharmacists, herbal dispenser, consultant, orthopaedist, obstetrician...” One can so easily form an incorrect opinion that youths are capable of taking care of their health issues by merely looking at their physique resultant from rapid growth. There are, however, many health-related challenges youths are psychologically facing with or without the knowledge of their parents or wards. These challenges are worth giving attention to due to the great threat they pose to their lives and the society. Therefore, timely intervention and involvement by every stakeholder is the best way to impact youths lives for healthful living to realise their potentials generally.

2.0 Methodology

This paper is primarily based on the study of health related-issues and its significant impacts on the youths in two rural Yorùbá towns, Ìdó-Òṣun, Oḍe-Òmu and Lagos as urban areas of our study. Although, the study focuses on the youths/young adults and health, evidence from scholarly works and external link materials from the Internet are employed to validate our analysis. More importantly, it is adequate to add that, being a qualitative research, Indepth Interviews (II) which involved twenty (20) youths and seven (8) health personnel in both Lagos and rural Yorùbá society (as data) were conducted. Among our respondents, are some youths that have health-related challenges that are peculiar to adults in the past while others developed health-issues due to some risk factors being explained in this paper.

3.0 Conceptual Clarifications of Fundamental Terminologies in the Study

As a background information, it is necessary to briefly clarify the basic terminologies in this paper, which are: **Youths, Health, Preservation, Rural and Urban Settings.**

(i) Youths: The qualities of vigour, freshness or immaturity as associated with being young. youthfulness. childishness. freshness. juvenility. bloom. ... The state or quality of being without guile, cunning, or deceit. greenness. innocence. simplicity. naivety. ... A boy or young man, usually in uniform, employed in a hotel or club to run ...¹

(ii) Health:- The answer to the question, “What is health?” depends on who you ask. The World Health Organisation (WHO) defines health as a state of complete physical, mental, and social wellbeing (WHO, 2012) Cockerham, (2004:6). Health comes from the Indo-European root

[kailo-] meaning whole, intact, uninjured. It is the same root from which we get the words whole, wholesome, hale, heal, holy, and hallow. Health, therefore, is wholeness or soundness.²

The meaning of health has evolved over time. In keeping with the biomedical perspective, early definitions of health focused on the theme of the body's ability to function; health was seen as a state of normal function that could be disrupted from time to time by disease. An example of such a definition of health is: "a state characterised by anatomic, physiologic, and psychological integrity; ability to perform personally valued family, work, and community roles; ability to deal with physical, biological, psychological, and social stress". Then in 1948, in a radical departure from previous definitions, the World Health Organization (WHO) proposed a definition that aimed higher: linking health to well-being, in terms of "physical, mental, and social well-being, and not merely the absence of disease and infirmity".³

(iii) Preservation:- More often than not, people have the passion to preserve material things than their health. Whereas, the saying that "prevention is better than cure," underscores the importance of preserving one's health to the best human ability possible. Preservation, the activity or process of keeping something valued alive, intact, or free from damage or decay preservation of state parks/monuments.⁴ Just as orthodox medicine lays emphasis on the essence of preserving community health, so also, is the Yorùbá indigenous healthcare delivery system through preservation of its cultural heritage in herbal medicine practices. The erroneous overview about herbal medicine, results from the point of view of some modern medicine practitioners, religious affiliation or "civilisation," have made it seemingly less popular or attractive, even among the general populace. The pragmatic experience of the ancient and modern Yoruba society about herbal medicine is a testament of its efficacy. This actually calls for a reconsideration for more scientific research for possibility of integration and collaboration with the orthodox medicine. Traditional herbal medicine that is scientifically standardised should be a welcome idea.

iv) Rural Setting:- In general, a rural area or countryside is a geographic area that is located outside towns and cities. The Health Resources and Services Administration of the U.S. Department of Health and Human Services defines the word rural as encompassing "...all population, housing, and territory not included within an urban area. Whatever is not urban is considered rural."⁵

(v) Urban Area:- An urban area or built-up area, is a human settlement with high population density and infrastructure of built environment. Urban areas are created through urbanisation and are categorised by urban morphology as cities, towns, conurbations or suburbs. In urbanism, the term contrasts to rural areas such as villages and hamlets and in urban sociology or urban anthropology it contrasts with natural environment.⁶ According to United Nations Statistics (United Nation, 1999), urban populations roughly doubled in the industrialised nations and quadrupled in the developing nations during the latter half of twentieth century (Takano, 2003:1). Much as Lagos is being classified as urban area, there are rural areas like: Makòko, Ajégúnlẹ̀, Ìwá, Mèran Village, Matogun, Àdò etc that are domiciled in Lagos.

4.0 The Rampant Experience of Youths Contracting or Developing “Adults-Related” Diseases in the Contemporary Yorùbá Society

From the responses of some of our respondents, there are separate but interrelated evidences that engender certain “adult-related” diseases that are now well-known among the youths in the modern Yorùbá society due to inability to abide with health principles. Irrespective of age, sex, region or health history, more youths are becoming predisposed to having some “adults-related diseases” like: obesity (*sísanrajù*), diabetics (*itò sùgà*), high blood pressure (*èjè ríru*), poor eyesight problem (*ojú wíwò bàìàbàì*), kidney problems (*àìàsàn kíðínrín*), cancer (*àìàsàn jejere*), venereal diseases (*àrùn gbajúmò/àìsàn ibálòpò*), substance abuse (*ilòkulò oògun/olóró*), fibroids (*oyún-ìju*), teenage pregnancy (*oyún òdóbínrín*), unsafe abortion (*oyún sísẹ-lónà-àitò*), Ear, Nose & Throat (ENT) (*àìàsàn-bétí-bámù- a-jẹ-mófún*), asthma (*àìàsàn-sẹmín-ín-ín-sẹmín--ín*), ulcer (*ogbẹ-inú*), depression (*irẹwẹ̀sì-ọkàn*) among others. Over the years, this problematic situation has led to high rate of untimely death (*ikú àitójó*) among the youths. Omígbòdùn & Aní (2014:4) laid emphasis on the medical ethics for the professionals and import of having regular check up by individuals in their affirmation that:

No medical procedure, assessment or intervention is risk free. Diagnostic practices are not different... it is important for clinicians to discuss the potential benefits and drawbacks of any proposed assessment with patients to allow the patients to give informed consent...Although parents usually seek the assessment, it is the child/young person who primarily bears any diagnostic label applied as a result of the assessment. Thus, obtaining the young person’s view, where appropriate is important.

The fear of stigmatisation is one of the major obstacles that usually prevents youths from making inquiry about the status of their health condition. The fact that some youths are not manifesting any outward symptom(s) does not mean that they are healthy. The main issue is that having any of the listed diseases coupled with reckless lifestyle makes youths to be predisposed to developing other(s). Besides, from responses of some gullible anonymous youths, there is evident of subtle illusion, due to lack of inadequate health orientation, misinformation by peer group or on social media that some diseases are peculiar to adults or could be managed with self-medication.

5.0 The Variables That Exposé the Convergent and Divergent Factors on Youths Health-Related Issues in the Yorùbá Rural Setting and Mega City

The phenomenon of health and its significance in human life is somewhat multifaceted. Therefore, health-related issues and how it affects the youths, future generations need to be tackled headlong. The implications of not giving health, particularly for youths, more attention it deserves in rural and urban areas has far-reaching effects. Our analysis is based on these

fundamental premises: parental roles, youthful exuberance, peer influence, environmental factor, implications of diet etc.

5.1 Preference for Peculiar Diets in Rural & Urban Areas:- Adénékàn (2007), affirms that “what you eat is what you get”. But how many contemporary youths have the understanding of the great impacts of nutrition in an individual’s life? Typically, Yorùbá staple foods and different local soups are usually well prepared by virtually every family in the rural setting. Láwore (2004:29) confirms that, “The meal of an average Yorùbá family is hot in terms of the spice content...the reason why the Yorùbá like hot taste lies in the fact that they believe that hot food clears the brain of debilitating mucus and makes the stomach settle rightly...” These foods are available in moderate quantity and fresh quality with different vegetables and fruits in abundance for community consumption. “One of the major concepts advanced by nutritionists over the years to teach proper nutrition is that of balanced diet, stressing variety and moderation...The key to sound nutrition is a balanced diet that is high in nutrients and low in calories” (Williams Anderson & Rawson, (2013:41).

Conversely, these staple foods, vegetables and fruits are available in Lagos markets. However, they are already stressed through way of carrying them from rural areas. Possibly, losing vitamins and nutrients to be derived before getting to the final consumers in urban city. Through information, most families in Lagos, due to time constraint, official or career engagements, do not have the comfort of preparing quality meals at home. More often than not, most urban youths prefer eating Sandwich wrap, Hamburger, Hotdog, Sharwama, Chicken nuggets, Indomie noodles, Pizza, Jollof/Fried rice etc at eateries like: *Shoprite, Mr Biggs, Chicken Republics, Domino* or *Sweet Sensation, CHEVYS, Underground* etc. “Children and adolescents drink substantial quantities of soft drinks both at home and away. Soft drink/soda are widely available at convenience stores, at fast food restaurants ...” (Worobey, Tepper & Kangrek, 2015:176). Consequent upon which lots of fatty foods with high salt-spices, frying meals with additive are being consumed by youths daily. Whereas, one could count at the finger tips the number of eateries being established or flourishing in the rural areas of our studies. This underscores the importance of youths eating balanced diet among other basic needs.

5.2 The Positive Impacts of Natural Life on Human Health:- One unique factor that characterises rural areas in Yorùbá society is the natural and serene environment. The beauty of nature in respect to mountains, forest, rocks, tress, breath-taking waterfalls, flowing rivers or unpolluted air are nature endowments that somewhat enhances human health. According to the United Nations Environment Programme, the earth’s resources are being consumed at an unsustainable rate and air pollution is one of the biggest environmental health risks across the globe. Beyond affecting the seas, wildlife and forests around the world, environmental factors take their toll on human health and wellness too.⁶

There is no gainsaying the fact that natural life enhances the potentials of having good health and longevity. Most towns that are referred to as rural areas, by their geographical locations, have beautiful natural environments. The inhabitants of rural areas have the opportunity of being close

to the natural world and being “nurtured” freely by nature. “What is considered everyday behaviour in one culture might be regarded as bizarre in another. What was acceptable at one point in time might seem absurd in contemporary society. What seems customary in one section of a large city, might be viewed as outrageous elsewhere” (Gurung, 2014:xix). This is contrary to Lagos life where both youths and adults are used to life with Air-conditioner, fan, and environmental pollution of all sorts. There is a need to campaign for a forestation and against deforestation in both rural and urban settings.

5.3 Exposure to Hazardous Mega City Life:- Though, a source of income to some people, the foul-smelling emission from the waste products at Kétu/Ojótá, Ilé-Epo Bus Stop along Fágba/Abúlé-Ègbá axis and Ìyàná-Ibà, aside from being an eye-sore, is very hazardous to the people living within the environment. The mountain of garbage in these areas couple with industrial air pollution, that have been scientifically proven to be dangerous to human health. Inhaling carbon emission from cars, generators and other waste products are also injurious to human health generally. To this, Takano (2003:2) affirms that: “On the other hand, although it creates economic growth, the infrastructure development, and sophisticated lifestyle, urbanisation also triggers new problems and issues bearing on multiple aspects of urban life, including food security, housing, employment, living environment, health of future generations, increasing levels of crime, violence, sex trafficking, drug abuse, and vulnerability to natural disasters. Urbanisation also increases the importance of crisis management for natural and man-made calamities and disaster such as outbreak of infectious diseases.” Air is non-negotiable for humans. We need it to survive, but we do not always take care to keep it clean, and that can have a significant impact on our health. Poor air quality has been linked to a wide range of health issues, including SIDS, lung cancer, and COPD.⁷

5.4 Activity-Packed and Sedentary Lifestyle of Youths:- A sedentary lifestyle is a type of lifestyle involving little or no physical activity. A person living a sedentary lifestyle is often sitting or lying down while engaged in an activity like reading, socialising, watching television, playing video games, or using a mobile phone/computer for much of the day.⁸ It is evident from the above definition that sedentary life, which characterises most youth’s lifestyle, is a great health risk factor for humanity. The central focus here is most youths, especially in Lagos where the trending phenomenon of watching films and social media is a norm. This provides an appropriate context to critically compare their counterparts in the rural areas as a way of reflecting on the health hazards sedentary life poses. Meltzer, Pinneo & Kitchelli (1973:6) affirm that:

Lack of physical activity has been incriminated as a risk factor in CHD, but the evidence of this belief is still inconclusive... Although there is good reason to believe that exercise may benefit the myocardium, it remains to be seen if physical activity (or inactivity) affects coronary arteries and influence atherosclerosis.

Experiences have shown that some grandmothers that were brought to Lagos by their sons and daughters from rural areas died within short time of arrival due to sedentary lifestyle they were not used to but subjected to with “too much dormant conformability.” This is unlike their counterparts that lived longer due to privilege of engaging in different physical activities and proactive communal life they are used to. A sedentary lifestyle can cause severe health issues, including cancer, diabetes, and poor cardiovascular health. Solutions include doing more exercise. The youths in the rural setting rarely have diabetes or high blood pressure, except in heredity cases, because there are few or no cars or air conditioner to enjoy. Mostly, they engage in trekking kilometres daily, thereby burn out fat or sugar away. It is understandable that the rigorous activities rural youths get involved in and exposures they have to series of infections agents and survive overtimes confer immunity on them or it reduces the impacts of the subsequent attacks.

6.0 Examination of Some “New” Adults-Related Diseases Among Contemporary Yorùbá Youths in Rural/Urban Settings

Some prevalent diseases among the modern youths were once attributed to adulthood, old age or particular sex. These diseases are not new, but the paradigm shift in their newness is based on reality that modern youths are developing them at alarming rate. Identifying some of these trending health issues with critical analysis and pragmatic suggestions, hopefully, would benefit the society at large.

(i) Menstruation:-This gender-based experience of monthly menstrual cycle of women vary from one woman to another. One of the health issues, a parent, mother in particular, always look forward to is the commencement of a young lady’s menstrual circle. The Yorùbá believe that having sex with a lady or women during her *period* would bring bad luck upon the man who engages in such unhealthy act. Besides, menses has metaphysical power to render the potency of traditional charms powerless. The Yorùbá people believe that monthly flow of “fluid” (menses) has metaphysical power that naturally boosts a woman’s health and longevity. Given the taboos and traditional belief about menstruation, most mothers, in rural setting are very particular about giving orientation, advice and suggestions to their young female children.

Conversely, most female youths in the mega-city do learn the basics or fundamental information about menstruation from peer group, the books they read or online. Often times, they do engage in self-medication, medication errors and drug abuse to “cure” menstrual pains without adequate information about the drug interaction in human system and medication implications on their health. “Therefore, among the Yorùbá women, as in other cultures, menstrual period is often problematic health wise. The popular notion of “menstrual pain” is proof of this claim” (Ọpẹfẹyítímí, 2009:35). The determination to be a virgin or not having sex regularly is also illogically considered to be responsible for intermittent stomach ache or potential factor for a man to develop prostrate or not being social. This superstitious belief has made gullible youths to

lose their virginity or contract sexually transmitted disease, all in the name of “everybody is doing it.”

(ii) Cancer:- Cancer refers to any one of a large number of diseases characterised by the development of abnormal cells that divide uncontrollably and have the ability to infiltrate and destroy normal body tissue. Cancer often has the ability to spread throughout your body. Cancer is the second-leading cause of death in the world. But survival rates are improving for many types of cancer.⁹

In the past, adults were known to have cancer of different types. However, the rampant cases of cancer affecting the youths in the modern-day calls for proactive measures. Evidence abounds that cancer could either be due to genetic factor or lifestyle such as smoking tobacco. Smoking is one of the predisposing factors for having cancer, especially cancer of the lungs. The heavier an individual smokes either as active smoker or passive smoker, the greater is the risk. Irrespective of sex or environment, the youths are greatly being affected by cancer in the modern-day. (Òpéfèyítímí, 2009:35) affirms that:

Budged and succulent busts, with sensitive nipples, pointed or dangling, constitute a peculiar trait and distinguished feature of the female human. Under normal conditions and circumstances, normal and healthy breasts make women romantically attractive. Unfortunately, breasts can pose serious problems of health consequences for women. In Lanson (1975:381), there is a list of problems and solutions connected with cancer of the breasts.

Asides from the cancer of the breasts which now affect both sexes, there are other types of cancer that could affect youths, depending on many variables like: diet, family health history among others. “Nevertheless, despite its rarity, cancer is the most common natural cause of death of teenagers and young adults and is exceeded in incidence only by accidental death,” (Grinyer, 2007:1).

(iii) Venereal Diseases:- In Yorùbá society, sex is always treated with dignity it deserves by the elderly people as sacred and ennobling. However, the experience of sexually transmitted diseases was peculiar to the adults. In the early 60s and 70s, venereal disease like gonorrhoea was often euphemistically referred to as “*àrùn gbajúmò*,” meaning a disease of social individual who have *Sugar Daddy* or *Sugar Mummy*. But, the rapid growth coupled with adolescent age often gives most youths the erroneous impression of having attained “adulthood.” Hence, the sexual urge, fantasy and infatuation of different attempts to experiment what is a typical of adults with the opposite sex gets stronger. Notably too, there is no distinction, between rural or urban youths in relation to sexual infectious because the world is a *global village*. Noticeably too, many female youths, who have contracted venereal diseases, are victims of rape, paedophile as relatives, neighbours or unknown rapist(s) nowadays.

Social media has exposed most youths to uncensored sexual contents as being deceptively portrayed on television, romantic magazine, *Youtube*, *Facebook*, *Whatsapp* etc. All a youth needs is a phone that can access the Internet. Despite the media sensitisation jingles and sexual-oriented programme for people that are sexually active to use condom and other protective measures, most youths are victims of venereal diseases like: syphilis, gonococci, even HIV/AIDS. Perhaps, due to lack of parental care, money-making reason, recklessness, incessant rape cases, peer pressure, materialism among other factors. Comparatively, this is more common among the youths in the mega-city going by responses of our respondents and personal observable experience. Cases of youths of ages fifteen (15) to twenty (20) and above, especially in the mega-city, writing to relationship therapist or sex counsellors, requesting for piece of advice over his or her sexual problems abounds in print media. The health implication of protracted or untreated STDs is further spreading of the disease or affecting procreation.

(iv) Smoking, Drinking & Drug Addiction:- The habit of smoking locally-made stimulants (*aásàà mímu/tábà fífin/ìkòkò mímu*) and drinking Yorùbá locally-brewed fermented drinks like: *emu*, *bùrùkùtù*, *otíkà*, *àgàdàgídí-otí-àgbagbà*, *ṣẹkẹtẹ* etc, was predominantly peculiar to the adults. Closely related to this is an attitude of eating kola nut or bitter kola (*obi/orògbó jìjẹ*). The essence of taking them is for reasons, ranging from being energy boosters, “mental alertness”, medicinal purposes, to overcome timidity during verbal arts performance, among others. However, the advent of production of cigarettes like *Benson & Hedges*, *Chesterfield*, *St’ Morris* (SM) etc engender the smoking cigarettes. In the past, it was tantamount to a taboo or insubordination for a youth in the Yorùbá society venturing into adult-related “freedom” of drinking and smoking. “The cultural relativism is the view that there are no universal standards rules for labelling a behaviour as abnormal; instead, behaviour can only be abnormal relative to cultural norms,” (Snowden & Yamanda, 2005:4). The singular honour a lad had, then, was to serve the elders’ drink with calabash, at the village square for communal bonding. One could rule out some resultant health challenges some adults faced or are facing by smoking and drinking lifestyle; depending on individual's level of immunity, body chemistry and family genetics history.

Today, there is high level of moral decadence, due to peer influence, the teenagers as active and passive chain-smokers and drunkards with impunity. This trend as evident in youths’ manner of socialising involves purchase of drugs from patent medicine vendors for pleasure, or “feel high” with its adverse effects on youngsters’ health cut across both rural and mega-city respectively. The usage of illicit drugs and its abuse like: Marijuana, cigarettes, cocaine, cough with codeine, tramadaol, by adolescents are on the increase in both rural and urban settings, with higher percentage in the metropolitan Lagos. This attitude is not gender-exclusive, as both young males and females, due to the influence of city life, are deeply involved in patronising club houses in Lagos. Various *sachet* alcoholic drinks and bottle drinks of mixed herbal substances like: “*Origin- 45% alcohol*,” and *Alomọ* are common on the streets. Today, several NGOs, or religious rehabilitating centres and Neuropsychiatric Hospital at Yábàá, in Lagos, are managing cases of

drug addiction and peculiar negative health outcomes. On the essence of socio-rehabilitation of human beings through medical intervention, Abott & Franciscus (1979:1) explain that:

Occupational therapy is the art and science of directing man's participation in selected tasks to promote and maintain health, to restore, reinforce, and enhance everyday performance, and to diminish or correct pathology caused by illness. Its fundamental concern is the development and maintenance of capacity to perform the roles essential to productive living and to mastery of self and environment. The primary focus of occupational therapy is the development of adaptive and coping skills which aid the individual in overcoming barriers to function, as well as the promotion of performance in relation to individual life styles.

The cases of young adults facing depression challenges from drinking and smoking are not that common in the rural setting as applicable to those in the mega-city. Those who have suffered heart problems from smoking, and live to tell the story, have experienced immobilisation necessary for health recovery to take place. If the Federal Ministry of Health, despite the tax and employment opportunity tobacco company offers, could enforce the warning inscription that “smokers are liable to die young” on every cigarette packets; then it is a food for thought for every smoker.



(v) **Obesity:-** Years back, there was an erroneous impression that being obese is a “sign of good living!” This gives an illusion that such body stature does not have health implication. From all indications, research has proven beyond any reasonable doubt that being obese is a health issue of physical ailment, either to an adult or youths. This observable fact is the rampant obese cases among the youths, particularly in the urban areas. The higher percentage of what causes obesity is the diet habits of most contemporary youths. By following the basic health principles,

youths would be in much better health situation to enjoy life rather than opting for “civilised” ways of life generally. Numerous CVD risk factors have been identified in the scientific literature, many of which can be reduced by participating in regular physical activity and exercise...The modifiable risk factors often can be significantly altered with lifestyle changes or pharmaceutical interventions e.g. are tobacco use, obesity, physical inactivity etc.” (Kohl, & Murray, 2012:76).

(vi) Poor Eye Sight:- “Most common visual problems are those involving refraction of light, i.e. inability of the light rays to converge on the retina. There are two common types of refractive errors,” (Boroffice, Bídèmi & Adèògún, 2003:41). Having poor sight, either as short-sightedness (*myopia*) or long-sightedness (*hypermetropia*), is often medically attributed with old age, especially when an adult attains the age of forty (40) and above. Poor sight, as being experienced by an adult, from medical perspectives, is an “exciting” situation that affirms the signs of attaining adulthood or old age. This controversial medical viewpoint solely depends on family background or genetic factors, as some people could see clearly or read without eye glasses, even at old age. The crucial issues of a child or youth having sight problem, nowadays, is often treated as minor health problems by the opticians, as long as there are no other complications related to major damages or hereditary. Evidence abound of many contemporary youths that are using recommended glasses, especially in the urban city of Lagos.

(vii) Fibroids:- “Fibroids are smooth muscle balls that grow predominantly in the uterus, and for the vast majority are benign tumours. They interfere with the blood flow in and through the uterus, and often cause disturbances in menstrual flow, making it heavy. They can interfere with fertility, and occasionally may cause the loss of pregnancy. Recent technological advancement have enabled gynaecologists and interventional radiologists to utilise a new range of approaches to fibroids. Small fibroids may hang within the cavity of the uterus or just beneath the endometrial (lining) surface may sometimes be removed through the use of a hysteroscope, a small telescope inserted through the cervix or through surgical procedure called myomectomy.”¹⁰ There are lots of propositions and studies about fibroids. Among the risk factors that could make a woman or young adult to be predisposed to it are: parative, that is number of children a woman had, hereditary, exposure to some hormonal contraception’s, age, race etc. With education, child-bearing of some female youths is being delayed nowadays and with resultant effects. High rate of fibroids may be found among women, irrespective of age. But, simply because it is a benign health condition, it rarely gives symptom(s) and many do not know they have it.

(viii) Poor Accommodation Spacing or Ventilation:- Though, very strong and withstanding the architectural test of time, some ancient mud houses in rural areas are not conducive for habitation. Such buildings should give way to modern styles that provides cross-ventilation and conduciveness. The cubicle or box-like windows, known as “*má rà-şáná*” should be replaced with bigger ones for enhanced illumination and ventilation. This problem and its health implications is affirmed in Oḍúnjò (1990:59) lamentation:

Ní pàtàkì, kí a ɣe àkíyèsí nínú àwọn ilú tàbí ìletò káàkiri, ní ibi tí òfin ilera kò ì múlẹ̀ tó bèẹ̀. Púpọ̀ nínú irú àwọn ilé bèẹ̀ ni kì í ní fèrèsé rará. Ní ìgbà púpọ̀ ihò fíntín-fíntín ni wọn máa ń dá sí wọn dípò fèrèsé ńlání tí wọn ì bá ní. Ìgbà púpọ̀ sì ni irú iyàrá bèẹ̀ sì máa ń ní àjà. Nípa báyii, imólẹ̀ àti atégùn kì í rí ààyè dé inú rẹ̀ dádára, gbogbo ilé a sì sòkùnkùn birbiri. Nínú irú iyàrá bèẹ̀ ni ọ̀pọ̀lọ̀pọ̀ àwọn èniayàn wa máa ń sùn ní alẹ̀. Iyàrá mīran máa ń kéré tó bèẹ̀ tí kì í lè gba méjì pò ní fẹ̀gbẹ̀-kan-ẹ̀gbẹ̀...

Most importantly, we should observe in most town or hamlets, where health rules are not well grounded. Most of the houses do not have windows. More often than not, they used to make little holes as opposed to big windows they ought to have. Mostly, such rooms have locally-made roofs. Consequently, they rarely experience illumination and fresh air, and darkness would pervade the whole house. In such rooms, some people would gather to sleep in the night. Some of the rooms could be so small that it would not contain two people side-by-side...

The main health challenge is the problem of inhaling carbon dioxide with choked oxygen by occupants. Developing common health-problem like cough, tuberculosis or cardiovascular diseases, due to poor aeration, could be mythologically attributed to the handiwork of the imaginary enemies as explained by Ọdúnjọ. A similar trend in Lagos is where a nuclear family of five are living in a room self-contain due overcrowding and economic problem. Besides, side-by-side storey buildings with no space in-between are very common in Lagos.

4.6 Depression:- (*Ìrẹ̀wẹ̀sì-ọkàn*) There are threefold risk factors of developing depression among the youths and young adults in Nigeria in particular: Biological factor which involves the use of certain narcotic substances, especially synthetic opium like tramadol, cocaine, heroin, etc which are readily available and at disposal of the youths. Secondly, it could be generic inheritance if mental illness runs in a family. This is what Yorùbá often socially stigmatised as “*wèrédìran*.” Finally, it could be due to current incessant social issue in the society. Among the adults, different calamities like: loss of lovable spouse, bankruptcy, fatal accident, terminal disease among other could make an individual become depressed. But, a traumatic experience like: physical abuse, drug abuse, sexually abuse through rape, incest, or harassment, incessant kidnapping, loss of loved ones could result into youth depression.

Sometimes, a seemingly insignificant “problem” being trivialised by adults due to maturity like: being jilted by lover’s inability to secure admission into tertiary institution, unemployment may cause a youth’s depression. There is high incidence of youths being depressed in urban area because factors mentioned are more prevalent in a mega city than the rural area. In the rural setting, a well-knit communal life characterises their worldview as one big family. The wrong notion about cost implication of accessing mental health care in Nigeria hospital often makes

some youths patronise herbal medicine as an alternative. However, there is lack of manpower in this field. Majority of youths that need intervention, close to 75% may not have access to desired health services. For example, there is only one functional Federal Neuro-Psychiatric Hospital in Lagos for the population of more than twenty million (20,000,000) Lagosians and servicing neighbouring rural areas. The experts are available in the seven Neuropsychiatric Hospital in Nigeria but are grossly inadequate. Besides, the facilities are inadequate.

4.7 Ears, Nose & Throat (Otorhinolaryngology) Health-Related Issues Among Youths:-

Ọláòṣun, et al (2014:11) asserts that, “Deafness in the elderly is usually due to presbycusis. This is the lessening of the acuity of hearing that characterises old age. It is due to a progressive degeneration in auditory system with ageing. It is said that moderate hearing impairment (45 dB hearing level averaged over 0.5, 1, 2 and 4 kHz) occurs in 4% of the age group 51-60 but in 18% of those aged 71-80 (Roland et al., 2001). Every aspect of medicine is very important. More so, the specialty of ear, nose and throat (head & neck) is vital to the body. The ear is the structure that helps in hearing, it also enables humanity to maintain balance. Through the nose we breathe and perceive aroma or foul odour. Some modern youths are unable to sense danger like gas leakages, due to nose problem. The most observable health-related challenges contemporary youths are having in relation to ENT is the usage or abuse of headphone and ear pod, which could either be wired or wireless through Bluetooth and earphone which is always wired. Continuous exposure of ears to noise is one of the risk factors that make individual to lose sense of hearing, provided it is not hereditary.

Inability to hear a sound by some youths that are addicted to earphones could cause avoidable car, factory or domestic accidents. Another variant is the sniffing of drug substances through the nose. This, overtimes, affects drug users smelling perception and also predisposes them to bleeding through the nose which is known as epistaxis. Smoking is also related to the cancer of the tongue, cancers of the throat, cancer of the lungs; invariably smoking can be predispose to carcinogenesis. Mere putting ear pod that is sold between ₦35,000 - ₦140,000 in the ears automatically prevents the user from hearing any other sound within his or her vicinity. The adverse effects of using, either earpiece, headphone or ear pod is the effect on the hearing mechanism or emission of radiation from phone which can cause cancer or affects brain cells. Taking care of youths, as it affects their health may be multidisciplinary approach of continuous health education.

However, it starts from informal home training and encouragement for youths to remain focused. Many youths may be ignorant of the side effects of what they are doing. Generally, it is unhealthy to use cotton bud or biro cover to remove ear wax, this is against the ENT-Ten as being asserted by Ọláòṣun, et al (2014). These ENT-ten rules that helps humanity to maintain ear, nose & throat health. One of it says, “Before you put anything in your ears, first of all insert your elbow!”. It is only when your elbow enters, then you are permitted to put anything in your ears. Cleaning ears debris (wax) with cotton can predispose to ear wax impaction, or traumatise the ear which predispose to infections or traumatise the eardrum. Putting a finger on the tragus

could easily solves ear-itching occurrence. The chart below is an overview depiction on how “religiously” general populace, with more focus on youths, in rural and urban areas are adhering to some basic health principles.

Table 1: Health Principles and its Application in Rural & Urban Areas

S/N	Health Principles	Rural Youths Disposition	Urban Youths Disposition	Effects on Health
1	“Early to bed, early to rise.”	Early sleep is common.	Clubbing/Traffic-The slogan of “City Never Sleeps.”	Inadequate sleep saps energy and productivity
2	Physical Activity	It is Lifestyle-general active lifestyle	Engage in only when overweight	Complicated health problems if not physically active
3	Diet Lifestyle	Eating more of whole eating staple foods, vegetables & fruits as a norm.	More of processed foods known craps or junks and food supplements as staple foods are relegated to the background.	Unhealthy eating habit predisposes to certain health problems like: obesity, kwashiorkor, hormonal imbalance. etc.
4.	Drinking Alcohol & Smoking	Somewhat financially incapacitated to get “enough.”	Prevalent cases of substance abuse and alcoholics.	Smoking & alcohol affect different human organs.
5	Active Sexuality	May be guided with traditional religion ethics, family taboos or communal supports till adolescence before being sexually active.	Sexually active before adolescent age and exposure to sexual abuse more than rural youths.	Exposure to early abortion, Contracting Venereal diseases etc.
6	Preoccupation in thought	Majorly preoccupied with schooling, learning a trade or as apprentice with tendency of early marriage.	Schooling, social media, clubbing, dating, and being prone to abuse by step-parents etc.	Depression, Insomnia & Loss of Consciousness common among youths in urban city.
7	Access to good health facilities	Lack of good health facilities	Availability of health facilities	trivial health issues may

		due to inaccessibility, poor roads, inadequate information.	but grossly inadequate given population explosion.	cause untimely death of youths in rural areas.
8	Environmental hygiene System	Serene and natural environment.	More challenges on environmental sanitation & pollution	Tendency to contract different diseases, epidemic or Pandemic by youths in the mega city.
9	Communal Lifestyle	Enjoy communal living	Most people are living in self-contained apartment.	Gives room for dialogue, moral supports and seeking wellbeing of neighbours.
10	Prone to patronise herbal medicine than orthodox medicine.	Preference for orthodox medicine with less patronage to herbal medicine.	Preference for orthodox medicine. Herbal medicine is often considered as being diabolical to healthcare delivery system by majority.	Orthodox has more interventions capacity to health challenges than herbal medicine that serves as the alternative remedy in some cases.

5.0 Suggestions or Recommendations for the Way Forward

- (i) With more proactive orientation on health-related matters and its significance, the youths could better be enlightened on the essence of taking their health with seriousness it deserves.
- (ii) Educating a girl child, for empowerment, who is often at the mercy of either a “responsible” or irresponsible husband could guarantee timely health intervention that could prevent complication or maternal death.
- (ii) Contemporary youths rarely read about health matters on social media, parents should consequently be Internet compliant to guide and engage their children on health-related topics of interest for better orientation.

- (iv) People living in Lagos could emulate the habit of creating time for cooking varieties to ensure eating more nutritious diet and acquisition of cooking skill for as part of recreation.
- (v) Lagos state government should be more proactive with sewage disposal and sanitation problems for better environment.
- (vi) Parents should take cognisance of healthful living of their youths before they become vulnerable and prone to being greatly influenced by peer group into many physical activities that could jeopardise their health or life.

Conclusion

It is evident from this study that the challenges posed by health-related issues are many and complicated to youths themselves. Inability to engage in critical examination about the implications of poor health on their life endeavours make youths to be involved in certain lifestyles that are detrimental to their health. The fundamental “new” health-related issues being raised, as it affects the youths with peculiarity or across board, are enough for societal concerns on taking proactive steps for timely intervention to secure health sector generally for youths’ wellness, productivity and longevity. The more society understands the risk factors youths are prone to in health-related challenges, the easier it will be to tackle them to safeguard youths. Besides, given the peculiarity of rural and urban areas, the suitable approaches to be employed for youth health-related problems depends solely on their peculiarity of their health cases, geographical locations, availability of medical facilities through synergy of orthodox and herbal; where applicable. More importantly, if humanity, especially scientists are paying serious attention, through research with substantial financial implications, on how some animal species would not go into extinction; then much more should be done for the “exclusive intermediate class,” youths in the Yorùbá society as well as other climes. There is no way to circumvent basic or natural health principles by youths, as future generations and leaders, and the society at large as being pragmatically suggested here. So, all stakeholders must take more proactive steps that could translate youths' lifestyle into more stable health.

End Notes

1. <https://www.bing.com/search.https://www.bing.com/search?q=etymology+of+the+word+health&form-> - Accessed on 12/8/2020.
2. <https://www.bing.com/search?q=etymology+of+the+word+health&form-> Accessed on 12/8/2020.

3. <https://www.bing.com/search?q=WHO+definition+o+health&form.-> Accessed on 12/8/2020.
4. <https://www.bing.com/search?q=define%20preservation&qsn&form.-> Accessed on 12/8/2020
5. <https://www.bing.com/search?q=define+rural+area&qsn=AS&pq=define+rural.-> Accessed on 12/8/2020
6. <https://www.theactivetimes.com/health-living/environment-affects-health-> Accessed - 17/8/2020.
7. <https://www.verywellhealth.com/what-is-environmental-health-4158207-> Accessed 17/8/2020.
8. <https://www.bing.com/search?q=what+is+sedentary+lifestyle-> Accessed 17/8/2020.
9. <https://www.bing.com/search?q=causes+of+cancer.-> Accessed 17/8/2020.
10. *Adventist World* (2008) Maryland: General Conference of Seventh-day Adventist. P. 11

References

- Abott, M. and Franciscus, M.L. (1979). *Opportunities in occupational therapy*. Illinois: VGM Carerr Horizons.
- Adébóla, G.O. (2015). "The use of herbs as an alternative method of healing in contemporary Nigerian society". In *Yoruba: Journal of Yoruba Studies Association of Nigeria* Vol 8, No1, 293-313.
- Ajíkòbí, O. (2013) *Ìṣẹ̀gùn ibílẹ̀ : Eja n' bákàn?* Lagos: Neronet Plus Int' Print+ Design.
- Cockerham, W.C. (2004). Ninth Edition. New Jersey: Pearson Prentice Hall..
- Grinyer, A. (2007). *Young people living with cancer: Implications for policy and practice*. England: Open University Press.
- Gurung, R.A.R (2014). *A cultural approach*. Australia: ADWORTH CENGAGE Learning.
- Lawore, O. (2004). *Cultural ethos of the Yoruba*. Ibadan; University Press PLC.
- Metzer, L.E., Pinneo, R. and Kitchell, J.R. (1973). *Intensive corollary care*. Maryland: The Charles Press Publishers.
- Odunjo, J. F. (1990). *Aláwíyẹ (Ìwé Karùn-ún)*. Ikeja: Longman Nigeria Limited.
- Omigbodun, O. and Ani, C. (2014). *Symposium on autism spectrum disorders papers*. Ìbàdàn: Oluben Printers.
- Orímóògùnjẹ, O.C. (2004). The Significance of Verbal Arts in the Yorùbá Indigenous Healthcare Delivery System, Ph.D Thesis submitted to Faculty of Arts, University of Ìbàdàn, Ìbàdàn.

- Olàṣun, A.O., Tobih, J.E. and Adédèjì, T.O. (2014). “The “ENT-TEN”: Ten rules of thumb in otorhinolaryngology that every doctor must know-A review” In *Academic Journals* Vol 6 (1) : 0-15.
- Òpéfèyítímí, A. (2009). *Women in Yoruba culture: A dozen of academic articles*. Ibadan: Penthouse Publications (Nig.).
- Òṣobà, B. and Òṣó, F. (2016). “Ìlò Oògùn Fún Ìdààbòbò Nínú Àwọn Ìwé Fágúnwà”. In *Òtun imò nínú itàn-àròṣo D.O Fágúnwà*. Lagos: Capstone Publications. 179-185.
- Oyewale, A.S. (2019). “Philosophical Analysis of Poetic Portrayal of the Yoruba Concept of Health is Wealth”. In *Journal of Research Findings (JoReFi)* University of Education, Winneba, Ghana. 2. (1). 80-110.
- Takano, T. (2003). *Healthy cities & urban policy research*. Oxfordshire: Spon Press.
- Worobery, J., Tepper, B.J. and Kangrek, B. (2015). *Nutrition and behaviour: A multidisciplinary approach*. Oxfordshire: CABI.

Table 2: Names & Addresses of Our Respondents

s/n	Name	Area of Specialisation	Rank	Age	Address	Date Interviewed
1	Mrs Adejoke Vincent	Public Health	CNO	62 years	Medical Centre, University of Lagos, Lagos.	12/8/2020
2	Mrs Foluso Oyelade	Midwife	PNO	52years	Medical Centre, University of Lagos, Lagos	12/8/2020
3	Mrs Adola Adekola	Midwife	ACNO	62 years	Medical Centre, University of Lagos, Lagos	12/8/2020
4	Dr. Opeyemi Emoruwa	General Medicine		62 years	Medical Centre, University of Lagos, Lagos	12/8/2020
5	Dr. Olugbenga Owoye	Pyschiatric Grade 1	Consultant/Director of Clinical Services	51 years	Neuropsychiatric Hospital, Yaba, Lagos.	18/82020
6	Dr. Oyinye Lazson	Obstetrics & Gynaecology	Resident Doctor	32 years	Federal Medical Centre, Ebute-Meta, Lagos.	21/8/2020
7	Dr. Taiwo Adedejii	ENT	Consultant	39 years	Ladoke Akintola University Teaching Hospital, Osogbo	22/8/2020
8	Pharm. Adeyinka Olutoye	Pharmacy		31 years	Rommar Pharmacy, 27, Ayangbunren Raod, Ikorodu.	24/8/2020

AN ANALYTICAL APPROACH TO MEASURING LIVING STANDARDS: EVIDENCE FROM LAGOS STATE COASTAL SLUMS

***Popogbe, Oluwaseyi Omowunmi, Akinleye, Simeon Oludiran and Oke, Mautin David**

Department of Economics, University of Lagos, Akoka, Lagos State.

*popogbeseyi@gmail.com

ABSTRACT

Although Lagos State is an urban city, lifestyle in many coastal slums in the State is appalling, does not befit humans and degrades the environment. This study aims at constructing a living standard index to measure the severity of living standard in selected Lagos State slums: Makoko, Iwaya, Ilaje, Ijora Badia and Amukoko. Adapting the Multi-dimensional Poverty Index (MPI) proposed by the Oxford Poverty and Human Development Initiative, this study adopted the living standard dimension with narrow focus on indicators such as: water supply, sanitation, electricity, flooring, cooking fuel and assets owned. The living standard dimension has been deliberately adopted because indicators to be measured have direct and indirect impact on environmental concerns in slums. Multi-stage sampling technique was adopted and using the formula by Hazra and Gogtay, 384 respondents were selected. Utilising the fuzzy set approach, the study found that the average living standard index for the five slums was 0.16; while Makoko had the highest living standard index of 0.19, above the average index. In order of severity, the result from the study confirmed that major contributing factors to the poor standard of living in the slums are drinking water, sanitation, assets owned and used, electricity usage, flooring materials and cooking fuel. Specifically, poor drinking water and lack of proximity to water sources contributed an average index of 0.04; poor sanitation practices such as poor toilet facilities and improper disposal of wastes also contributed 0.04 to the average index. Use of electricity, cooking fuel, assets and flooring indicators however contributed 0.02 each to the living standard dimension. The study therefore recommended the need to provide accessible potable water and encourage drinking well-treated water; enforce proper sanitation practices and adopt clean energy. These will improve the standard of living of slum dwellers and also reduce environmental pollution.

Keywords: Slums, Indicators, Fuzzy Set, Living Standards

JEL Classification: I30, I31, I32

1.0 Introduction

As a result of rising urbanisation and globalisation, slums are fast becoming a common feature of urban cities across the world (Bag et al., 2016; Abdi et al., 2018) with a larger majority in developing countries (Olalekan, 2014; Mahabir et al., 2016). Slum prevalence in developing

countries is however a major concern for governments because of the inherent economic, social and psychological effects on the slum inhabitants. Again, governments are struggling to provide basic amenities for people who are legally living in the city and having to provide for the slum dwellers that constitute largely the urban poor is more overwhelming.

Nigeria has the highest population in Africa of over 200 million people (World Population Prospects, 2020) and the largest city in the Country is Lagos State. Apparently, Lagos State is the seventh largest economy in the world, the third in Africa and the first in Nigeria (Nwagwu and Oni, 2015). As a result of the economic viability of the state, the migration of people into Lagos State from within and outside Nigeria has increased. From a low population of 345,000 in 1952, the Lagos State population increased 2.49 million in 1980, 8.01 million in 2005 and by 2019, it had increased to over 21 million in 2016 with the tendency of about 10% increase in the population growth rate per annum (Lagos Population Commission, 2018). Furthermore, Lagos State is a coastal state (with only about 37% as the dryland area); therefore, tenure loose areas are a common feature of the city (Birkmann et al., 2017). Slum settlements are thus mostly seen along and around coastal lines in Lagos State and the constant environmental and climate conditions they encounter further increase their vulnerability (Ajibade and McBean, 2014).

Promises of better earnings and conditions of life are fascination reasons for which people leave their rural settlements to move to the city (Bag et al., 2016). However, many migrants are oblivious of the fact that although the standard of living in urban cities may be higher, however, so is the cost of living. They look out for tenure-loose areas and form settlements (slums) in and around the city. Often times, government try to evict slum dwellers and destroy their habitat, however, it has been observed as a result of the inability to meet up with the high class city live, slum dwellers look out for similar habitats which are naturally less inhabited and continue their living (Ige and Nekhwewa, 2014). Slum dwellers to a large extent provide cheap labour and have been seen to significantly contribute to the economic growth of cities (Bag et al., 2016).

However, despite the seemingly cheap labour possibilities presented by slum dwellers, their habitat is generally characterised by poor living standards which negatively impact the lives of those living in the slums as well as the immediate environment evident in contaminated soil and waterways (Joshua and Glanda, 2016; Mahabir et al., 2016). Access to potable water is abysmally available; sanitation practices are poor; access to electricity is poor; and basic amenities are rarely accessed and enjoyed. As a result, slum dwellers wallow in a vicious cycle of poor living standards which cause ill-health for large number of these slum dwellers (Abdi et al., 2018). Again, slum dwellers are exposed to natural disasters as a result of the geographical characteristics of slums coupled with poor environmental practices; these largely impact poverty levels of slum dwellers by causing them to fall deeper into poverty traps after the occurrence of natural disasters and climate events (Nasrim, 2012).

Indeed, the deprivations suffered by slum dwellers are multi-faceted and cannot be explained in a single term. These deprivations are exhibited in different dimensions and indicators. In 2010, the Oxford Poverty and Human Development Initiative (OPHI), with the understanding that

deprivations are multi-faceted, came up with a global multi-dimensional poverty index that will better capture deprivations instead of the conventional uni-dimensional approach of using consumption expenditure or income received (Oxford Poverty & Human Development Initiative (OPHI), 2019). The core dimensions in the global MPI are education dimension, health dimension and living standard dimension. Each of these dimensions also has sub-indicators that broadly capture the dimensions.

This study however focuses on the living standard dimension because it covers critical indicators that focus on sanitation and hygiene issues. The “functionings” of an individual to a large extent depends on the living standard in place and if such living standard is poor, it can trigger other multi-dimensional deprivations for such an individual (Chakravarty, 2019; Patel et al., 2019). Again, aside the negative impact the poor living standards has on individuals’ health, poor sanitation practices the environment is exposed to have long-run impact on the city (Ige and Nekhwevha, 2014; Mahabir et al., 2016).

The earlier governments and policy makers started improving the living standards of slum dwellers by integrating them in their development agenda, the better for the long-run development of such economies (Bag et al., 2016). This is because UN-Habitat has envisaged a continuous rise in slum settlement with about two-third of the world population living in urban areas by 2050 (United Nations Human Settlements Programme, 2015). Realizing that slums will continue to be a major feature of cities, government should therefore endeavour to include them in their development agenda.

While many researchers have adopted a qualitative approach to explain the deplorable living standard seen in slums, to the best of our knowledge, none has adopted an analytical approach to estimating the living condition especially in the major slums of the urban city of Lagos. Assigning appropriate weights to indicators and developing a multi-dimensional living standard index for Lagos State slums is thus a welcome development. This will enable us understand the degree of deprivation in each of the indicator measured and thus provide a framework for priority interventions.

2.0 Literature Review

There is no single definition of slum. However, slums are generally defined based on poor environmental and living standard inherent in the slum communities. UN-Habitat (2003) defines a slum as a settlement lacking access to potable water, access to improved sanitation facilities, sufficient-living area, durable housing structure and having secured tenure. Some other scholars added that slums generally are locations occupied by “socio-spatially isolated group” of people whose choice of habitation are largely influenced by work ethics rejection and other anti-social values. Also, slums are mostly occupied by unoccupied unskilled labour force and thus breed vagabonds and juvenile delinquents. The environmental conditions also portray highly sub-standard living standards (Abotutu, 2014; Mahabir et al., 2016).

Slums are neglected parts of the city inhabited by the low-income group with little or no formal education. Basic amenities such as good roads, electricity and water are lacking. Slums dwellers are also deprived of proper drainage facilities, waste disposal, toilet facilities, basic assets such as television, computers, etc. (Ige and Nekhwevha, 2014; Olalekan, 2014; Bag et al., 2016; Bird et al., 2017). The land is mostly swampy with wooden piles and bamboo laid out on the soggy land. The streets are smelly and when it rains, lives and properties are endangered due to flood (Ige and Nekhwevha, 2014). Living standards on the other hand is a complex phenomenon (Bennett, 1937) which has evolved from various definitions (Birčiaková et al., 2015). Although the most widely used is the per capita GDP, however, it has been criticised as being not sufficient to measure human welfare (Krugman and Wells, 2012). Again, the GDP per capita does not capture many items that affect people's lives (Birčiaková et al., 2015). The global MPI on the other hand adopts a multi-faceted approach by classifying the different indicators under living standard as water, sanitation, electricity, flooring, cooking fuel and asset (Alkire and Santos, 2010). This study therefore adopts these indicators in estimating the multidimensional living standard deprivation seen in slums.

Numerous empirical studies have been carried out to examine the deprivations experienced by slum dwellers. Abdi et al. (2018) researched on identifying health conditions of some urban slums at Bangalore, India using a combination of secondary and primary data. The study found that the critical health challenges faced by the slum dwellers include diabetes, hypertension, dengue fever, malnutrition and diarrhoea in children and anaemia in child health and women. The study thus recommended the development of technologies coupled with implementation of interventions that can improve the health status of people in the slums. On a broader perspective compared to that of Abdi et al. (2018), Mahabir et al. (2016) adopted descriptive statistics to examine the positive and negative effects of slums on the society. It was observed that an attempt to improving the living conditions on slums will imply a significant burden on taxpayers; however, on another hand, slum dwellers also positively contribute to the economic growth through their activities in the informal sector. The study therefore advocated that countries have to take up the challenge of rising prevalence of slums and strike a balance between providing good living conditions for slum dwellers and using available economic resources.

Still examining the living conditions of slum dwellers, Bag et al. (2016) carried out a comparative analysis on three slums in India. The study also adopted the use of descriptive statistics and found similar conditions across the three slums. Majority of slum dwellers were migrants from neighbourhood states, many of them hardly completed the average years of schooling while more male participated in the labour market compared to females. This shows that economic opportunities were greater for men compared to women. The structure of the houses and access to sanitation and drinking water were however considerably different across to the slums. This shows that different conditions may sometimes be observed in different slums in same country. Another interesting finding from the study was that many of the slum dwellers felt satisfied with their habitation which is rather a paradox. This is similar to the findings by Ige and Nekhwevha (2014). Ige and Nekhwevha (2014) examined the willingness of slum dwellers to

relocate vis-à-vis the economic deprivation suffered. A one-way Analysis of Variance (ANOVA) was utilised in data analysis and it was found that slum dwellers suffered from absolute deprivation in Ijora Badia slum, in Lagos State, Nigeria. The study found that the willingness of the people to relocate depended on their social economic status. Therefore, the more deprived an individual is, the more unwillingly the person is to relocate.

Similarly, Bird et al. (2017) also examined the characteristics of slums by carrying out a comparative study using microdata from the Kenya Population and Housing Censuses for 1999 and 2009. It was observed generally that living conditions improved to a large extent within the two periods and the living conditions in the slums were better than those in the rural areas although worse than those found in the city. The study thus opined that there was potential for improvements in the slums as well as socio-economic development. Understanding the likely potentials beneficial to the larger society, Daniel et al. (2015) asserted that eviction may not be the right approach to dealing with slum problems in the city since evicted households are left homeless. Adopting qualitative statistics, Daniel et al. (2015) opined that oftentimes, ignoring slum conditions lead to poorer living conditions. Again, Nigerian government sometimes violate housing rights by violently evicting slum dwellers and destroying their habitat without providing them alternative housing. The adaptive approach and dialogue with slum dwellers may thus be an appropriate means to improve their standard of living.

Doris (2014) focused on two aspects of the living standard dimension that are closely linked: water and sanitation in Ghana. Using descriptive statistics, the study found that there was poor access to water; long hours getting water; high cost of water; and minimal usage of water consumption (due to complications in getting the water). As a result of difficulty accessing water, the sanitation practices are also poor. Open defaecation is a common practice and the bathrooms are dirty. All these unsanitary practices degrade the environment and make the dwellers more susceptible to health issues. A similar poor sanitation practices was observed at Jimeta-Yola, Adamawa State, Nigeria. Joshua and Glanda (2016) found that absence of drainages led to flooding during raining seasons and residents also indiscriminately disposed wastes on the roads and shallow drainages available. The study thus recommended upgrade of the slums through proper planning and also provision of proper and adequate waste bins for waste disposal.

Slum households are largely vulnerable as a result of the environmental conditions they are exposed to. Ajibade and McBean (2014) critically examined the risks from these environmental factors. The authors opined that limited and weak urban housing capabilities drive people to live in areas that should not normally be inhabited by people. Using qualitative and quantitative techniques, the study found that a major environmental factor being encountered by these people is flooding which further endanger the lives of the slum dwellers and reduce their adaptive capacity. Ajibade and McBean (2014) therefore recommended reduction in housing marginalisation coupled with participatory environmental management. Examining the impact of environmental degradation on women empowerment in selected South Asian slums, Patel et al.

(2019) adopted the use of both quantitative and qualitative techniques in creating the Women's Empowerment in Slums Index (WESI). Basic factors that negatively influenced women's empowerment in the slums were shorter stay in the slums, overcrowding, poor toilet facilities and flooding. It was also observed that extreme climate conditions arising from poor environmental practices accounted for low empowerment of women in many of the slums.

Using a counting approach framework, Bag and Seth (2017) analysed the monetary and non-monetary outcomes of standard of living in three major Indian slums. The study found that monetary standard of living is quite different from the non-monetary approach. The non-monetary approach was however multifaceted covering many aspects such as sanitation, water, housing structure, tenure rights, etc. The study gave recommendations on reducing monetary and non-monetary standard of living depending on the severity of each approach. In a similar vein, Birčiaková et al. (2015) also adopted an analytical approach to estimating living standards in selected European countries. Both monetary and non-monetary approaches were also used in measuring the living standards in these countries with focus given to economic, environmental and social factors. The study found that factors such as high population density, increased healthcare and education expenditure and the release of carbon dioxide into the environment negatively impacted living standards. However, Birčiaková et al. (2015) asserted that the use of the monetary approach did not fully reflect the living standards.

3.0 Theoretical Framework and Methodology

3.1 Theoretical Framework

Fuzzy Set Theory: The fuzzy set theory as propounded by Zadeh (1965) has received great attention in literature of recent due to its ability to measure deprivations giving focus to the degree of membership of an individual/household to a particular deprivation. Zadeh (1965) introduced the theory in order to alleviate problems of ambiguity in measuring deprivations. Zadeh (1965) specifically opined that the “notion of the fuzzy set is to provide a convenient point of departure for the construction of a conceptual framework which parallels in many respects the framework used in the case of ordinary sets, but is more general than the latter, and, potentially, may prove to have a much wider scope of applicability, particularly in the fields of pattern classification and information processing. Essentially, such a framework provides a natural way of dealing with problems in which the source of imprecision is the absence of sharply defined criteria of class membership rather than the presence of random variables”. It is always not possible to classify an individual being deprived or not deprived in a dimension; the fuzzy set theory however provides a framework to determine the degree of membership to the dimension being measured (Chakravarty, 2019). The values of membership function range between 0 and 1- with 0 as non-membership and 1 as full membership. The deprivation is further examined based on the individual falling below or above a threshold which is known as the cut-off. To allow for the different nature of a person's characteristics and various levels of need, the fuzzy set theory proves relevant (Kouassi and Seka, 2017). The theory has been deduced to be robust in studying

multi-faceted deprivations in developing countries (Oyekale and Okunmadewa, 2008; Pathinathan and Kumar, 2014; Kouassi and Seka, 2017)

In defining fuzzy set, we assume X to be a set (universe); and B is the fuzzy subset of X , if B is a set of ordered pairs:

$$B = [(X, \mu_B(X), x \in X] \quad 4.1$$

Where $\mu_B(X)$ is the grade of membership of X in B . $\mu_B(X)$ takes its values in the closed interval $[0, 1]$. The closer $\mu_B(X)$ is to 1, the more X belongs to B ; the closer it is to 0

3.2 Methodology

The study areas adopted for this study are Iwaya, Makoko, Ilaje, Amukoko and Ijora Badia. These areas have been identified by the World Bank as some of the largest slums in Lagos State. Again, they have been selected on the basis of their proximity to the Lagos State coastal line which exposes them to more environmental danger. Due to the spatial nature of slums and sparse demographic data, there is a large restriction to accessing survey data on slums (Mahabir et al., 2016). As a result, it is difficult putting a figure on the number of people living in each selected slum in our study. We therefore adopted the formula of Hazra and Gogtay (2016) to select the sample size for the unknown population. We thus have:

$$\text{Sample size} = ([RD] [1 - RD]) / ([ME/CL \text{ score}]^2)$$

Where ME is the degree of deviation from the real result which the study can tolerate (5%)

CL is the degree of uncertainty that can be tolerated/Confidence level (1.96)

RD is the confidence level (0.5%)

$$([0.5] [1 - 0.5]) / ([0.05/1.96]^2) = (0.25/0.00065077) = 384.16$$

A schedule was employed to interview respondents across the communities and the survey was held between November 2019 and February 2020. Approval to carry out the survey was gotten from community heads; they also helped in classifying the study area into clusters based on the density. There were two clusters at Makoko and Iwaya and Ijora Badia and 3 clusters at Ilaje and Amukoko. Due to pedestrian restriction at Makoko coupled with language barrier, only 50 household heads were interviewed, however, at Ilaje, Iwaya, Amukoko and Ijora Badia: 86, 82, 90 and 83 household heads respectively were randomly selected across the clusters. 400 schedules were administered across the communities; however, 7 of the schedules were incomplete and were excluded, thus a valid total of 393 responses were used for further analysis.

Both descriptive and analytical techniques are adopted in estimating the severity of the living standards in the selected slums. In order to calculate the living standard deprivation, the

analytical technique adopts the fuzzy set approach following the steps proposed by Betti et al., (2015) in poverty measurement:

- i. Identification of variable: A schedule was prepared and covers the basic living standard indicators proposed by Oxford Poverty and Human Development Initiative (OPHI)
- ii. Conversion of items into interval 0,1
- iii. Carrying out a factor analyses: This is necessary to ensure that all the items are appropriate for the dimension being measured.
- iv. Calculation of weights for each indicator: Adopting the indicators of the OPHI-living standard dimension, weights are assigned to the indicators based on the severity experienced in the slums
- v. Calculation of the indicators under the living standard dimension for the overall measure given: For individual i , aggregated sum of items in a group $h= 1, 2, 3, \dots, m$ is given as the unweighted mean over the group of item thus:

$$LSI = \frac{\sum_h LSI_{hi}}{m}$$

Where LSI= Living standard index

It is acceptable that the measurement of living standard has both conceptual and empirical issues. As such, we extract the living standard of the global multidimensional poverty index (MPI) developed by the Oxford Poverty and Human Development Initiative (OPHI) and the United Nations Development (UNDP) in 2010. These indices are robust and reveal severe deprivations in measured indicators (Alkire and Santos, 2010).

4.0 Result Presentation and Discussions

Table 4.1 Distribution of Socio-Economic Information of Respondents

Variables	Frequency	Percentage (%)
Gender		
Male	179	45.5
Female	214	54.5
Age distribution		
25 and below	73	18.6
26-35	120	30.5
36-45	96	24.4
46-55	53	13.5
56-65	32	8.1
above 65	19	4.8

Marital Status		
Single	33	8.4
Married	330	84
Divorced	7	1.8
Widowed	20	5.1
Separated	3	0.8
Years of Formal Education		
6 and below	209	53.2
7-9.	26	6.6
8-12.	119	30.3
13-16	29	7.4
above 16	10	2.5
Nature of Family		
Male Headed	349	88.8
Female Headed	44	11.2
Household Size		
4 and below	141	35.9
5-10	236	60
above 10	16	4.1
Age distribution of household members		
0-17	283	72
18-55	107	27.2
56 and above	3	0.8
Employment Status		
Salaried	27	6.9
Self -Employed	334	85
Retired	16	4.1
Unemployed	16	4.1
Average Daily Income Earned		
N1000 and below	141	35.9

N1001-N2000	121	30.8
N2001-N3000	63	16
N3001-N4000	21	5.3
N4001-N5000	28	7.1
N5001 and above	19	4.8

Source: Authors' Computation (2020)

The distribution of the socio-economic information of respondents show that there were 214 females and 179 males who participated in the survey which brings the total number of respondents to 393. Of these 393 respondents, a large proportion of the respondents fell within the age range of 26-35 years while the least proportion of respondents were those above 65 years. This shows that majority of the respondents were young and belong to the working class group. About 84% of the respondents were also married while a few were divorced. As expected and common with slum dwellers (Alkire and Shen, 2017; Mishra and Banerjee, 2020), majority of the slum residents had little formal education of 6 years and below. Another large proportion (30%) had 8-12years of formal education. Therefore, while majority had few years of primary education, many also had secondary school education and very few however had tertiary education.

Most of the households were headed by males while only 11% of the households were headed by females. Consistent with previous studies (Alkire and Shen, 2017; Biyase and Zwane, 2017), a large percent of the households had large household members. In fact, only 36% of the households had members of 4 people and below, with majority having members of 5-10 people. The age distribution of household members show that majority of members were dependent aged 0-17years while few households had only aged people living in them.

On the economic information of the respondents, 85% of them were self-employed, 7% salaried workers and 4% retired and unemployed respectively. A large part of the respondents own and manage their own businesses (largely petty trading) and this is not surprising as a result of the poor educational background possessed by majority of the respondents. The daily earning of the respondents averaged N1000 and below for most of them (this is lower than \$2.5) and this is also used in meeting the needs of the family. Therefore, many household heads struggle to expand their businesses as well as meet up with basic needs.

Table 4.2: Communal Decomposition of Living Standard Index (LSI)

	Makoko	Iwaya	Ilaje	Ijora Badia	Amukoko	
Indicator	Indicator Score					Total Score

Water Usage	0.042	0.039	0.042	0.037	0.036	0.083
Sanitation	0.047	0.044	0.037	0.035	0.031	0.083
Electricity	0.024	0.022	0.021	0.022	0.020	0.042
Flooring	0.021	0.021	0.018	0.016	0.015	0.042
Cooking Fuel	0.024	0.020	0.015	0.018	0.011	0.042
Assets	0.028	0.027	0.023	0.026	0.021	0.042
LSI	0.185	0.173	0.154	0.154	0.135	0.333

Source: Authors' Computation

Table 4.2 shows the trend in the indicators measured across the communities. Measuring the water deprivation, Makoko and Ilaje have an index of 0.042 of the total score assigned to the indicator, 0.083. Iwaya scored 0.039, Ijora Badia scored 0.037 and Amukoko, 0.036. These indices show that Makoko and Ilaje communities are severely deprived in the use of potable water compared to other locations. The sanitation indices show a worse trend compared to water in Makoko with a score of 0.047, Iwaya follows with a score of 0.044, Ilaje, 0.037, IjoraBadia, 0.035 and Amukoko, 0.031. Although Makoko and Ilaje both suffer from severe water deprivation, the sanitation indices show that Makoko and Iwaya have severe sanitation deprivation. The electricity, flooring, cooking fuel and assets indicators were assigned lower weights since literature has opined that sanitation and water usage are two critical living standard issues encountered by slum dwellers (Doris, 2014; Joshua and Glanda, 2016; Bag et al., 2016; Bag and Seth, 2017). Again, Makoko scored the highest electricity index of 0.024, Iwaya and Ijora Badia scored 0.022, Ilaje scored 0.021 and Amukoko, 0.020. From the indices estimated, all the locations suffer from severe electricity usage. Indices of the flooring indicator reveal Makoko and Iwaya having a score of 0.021, Ilaje, 0.018, Ijora Badia, 0.016 and Amukoko, 0.015. This implies that only Makoko and Iwaya have severe flooring deprivation.

The cooking fuel indicator shows a worse index compared to flooring in Makoko and Ijora Badia with scores of 0.024 and 0.018 respectively, However, Iwaya, Ilaje and Amukoko got lower scores of 0.020, 0.015 and 0.011 respectively. Similarly, to the findings of the flooring index, Makoko and Iwaya also have severe flooring index as their scores were above the cut for the indicator. Finally, the trend in the asset indicator again reveals Makoko has the poorest index of 0.028, Iwaya, 0.027, Ilaje, 0.023, Ijora Badia, 0.026 and Amukoko, 0.021. Although Makoko has the poorest index, all the locations are severely deprived in the area of asset ownership.

Discussion

The findings from this study show that Makoko had the poorest index across all the indicators measured. Besides this, all the indices are very close or above the mid cut-off score of 50% for each of the indicator. The indicator with the highest score for Makoko was sanitation; and indeed, the environmental conditions at Makoko show very poor sanitation practices. There are

very poor toilet facilities and open defaecation is a common practice. The sanitation indicator also had the highest index in Iwaya. However, water usage scored the highest index at Ilaje, Ijora Badia and Amukoko amongst all the other indicators measured. In Makoko and Iwaya, their index shows a severe deprivation in sanitation with scores above the 0.04 (50% of the total score for the indicator) cut-off. Poor water usage is attributed to very far sources of water which comes with associating costs in all the communities; it is especially worse at Makoko and Ilaje.

The asset indicator next reveals high level of depravity. Although Amukoko had the lowest index of 0.021, we see that this score is also the cut-off score for this indicator which shows severe asset poverty. All the other communities have higher severe asset deprivation with their scores above the cut-off. This shows that many of the respondents have little to no household items such as a TV, fridge, and sets of furniture; and do not possess landed properties or own a car. Majority however possess mobile phones which is a common asset across all the communities. All the slum communities had electricity index above the cut-off or exactly the cut-off score but electricity usage according to the respondents is not a major concern, thus as many of them do not even have supply to their homes.

Flooring and cooking fuel have close indexes across the communities; however, Makoko still remains severely deprived in these two indicators with Amukoko being the least deprived. While Makoko and Iwaya suffer from severe flooring and cooking fuel deprivation, Ilaje, Ijora Badia and Amukoko scored below the cut-off for these indicators showing lower deprivation level. The flooring index examines the housing construction materials and its durability. At Makoko and Iwaya, most of the houses are made of wood while many of the respondents in these communities also use charcoal or wood as major source of cooking fuel. This is rather not encouraging as many respondents in other communities now use clean cooking fuel such as gas in cooking activities.

In summary, the living standard index reveals that Makoko has the highest index of 0.185 which is quite expected following the highest deprivations scores seen across all the indicators measured. Iwaya scored 0.173, Ilaje and Ijora Badia each scored 0.154 and Amukoko scored 0.135. Given that the total weighted score for the living standard index is 0.333, the 50% cut-off gives 0.166. Makoko and Iwaya scores are above this cut-off revealing severe LSI; Ilaje and Ijora Badia scores of 0.154 each shows that they are close to the cut-off and have a high probability of falling into severe LSI. Amukoko community score of 0.135 however shows that although the community is deprived in living standard, it is not severe. A score below 0.05 would have revealed high quality of living standard but this is not obtained in any of the communities.

5.0 Conclusion and Recommendation

This study analyses the degree of living standard in selected slums in Lagos State by focusing on the living standard indicators as given in the global multidimensional poverty index. The results of this study show that all the slums have poor living standards with Makoko and Iwaya having

severe living standard indexes. Poor access to potable water; unsanitary practices; epileptic power supply; poor housing units; the use of unclean cooking fuel; and lack of household assets all contributed to the varying degree of living standard index. However, the study showed that Makoko suffered severe living standard deprivation in all the indicators; while Amukoko fared best by scoring the least index in all the indicators measured. While Makoko and Iwaya scored severe living standard index in all the indicators, Ilaje, Ijora Badia and Amukoko suffered severe deprivation in only electricity and cooking fuel. The findings show that living standard deprivation varies across slums and it is important to understand the dynamics of the living standard deprivation in each slum for better intervention. However, generally, the following provides an outlook into the implementation of better living standard in the slums:

- i. Provision of potable water with closer proximity to the people and at little or no cost. The issue of not treating drinking water was one of the factors that constituted the water deprivation. Residents should therefore be periodically sensitised on the importance of treating drinking water before use.
- ii. Indiscriminate dumping of wastes on waterways (especially in Iwaya and Makoko) should be stopped and waste management authorities in the Lagos State should implement practical steps to stop this and sanction should be imposed on defaulters. Waste disposal by relevant authorities should be consistently carried out in these locations to further discourage dumping on the waterways.
- iii. Slum upgrade in the area of housing units by the Ministry of Housing is recommended. Most housing facilities in Makoko and Iwaya are made of wood which are not durable and may not withstand environmental disaster such as flooding or storms.
- iv. Although clean fuel such as gas is used by many residents in some of the communities, Makoko and Iwaya still use more of charcoal, wood and kerosene in cooking. Residents should be sensitised on the importance of using clean fuel and this can also be provided to them at a relatively cheaper cost.
- v. Epileptic supply of electricity is a major problem in all the communities examined. Better supply of electricity should be ensured as this improve their living standard.
- vi. While the asset ownership may not directly impact the environment, however, an improvement in assets ownership will better enhance the living standard index of the people and make their lifestyle more comfortable. This may however be the least of policy interventions for policy makers.

References

- Alkire, S. and Santos, M.E. (2010). Acute Multidimensional Poverty: A New Index for Developing Countries. OPHI Working Paper 38
- Alkire, S. and Shen, Y. (2017). Exploring Multidimensional Poverty in China: 2010 to 2014. Research on Economic Inequality: Poverty, Inequality and Welfare, 25, 161-228.
- Bennett, M.K. (1937). On Measurement of Relative National Standards of Living. The Quarterly Journal of Economics [online], 51(2). DOI: 10.2307/1882091.

- Betti, G., Soldi, R. and Talev, I. (2015). *Fuzzy Multidimensional Indicators of Quality of Life: The Empirical Case of Macedonia*. *Social Indicators Research*, 127(1), 39–53.
- Birčiaková, N., Stávková, J. and Antošová, V. (2015). Evaluating living standard indicators. *DANUBE: Law and Economics Review*, 6 (3), 175–188
- Bird, J., Montebruno, P. and Regan, T. (2017). Life in a slum: understanding living conditions in Nairobi's slums across time and space. *Oxford Review of Economic Policy*, 33(3), 496–520
- Biyase, M. and Zwane, T. (2017). An empirical analysis of the determinants of poverty and household welfare in South Africa. *The Journal of Developing Areas*, 52(1), 115-130, <https://doi.org/10.1353/jda.2018.0008>
- Chakravarty, S. R. (2019) ed. *Poverty, Social Exclusion and Stochastic Dominance*, Themes in Economics, 1-11, Springer Nature Singapore Pte Ltd
- Daniel, M., Wapwera, S., Akande, E., Musa, C. and Aliyu, A. (2015). Slum Housing Conditions and Eradication Practices in Some Selected Nigerian Cities. *Journal of Sustainable Development*; 8(2), 230-241
- Doris, F. (2014). Water and Sanitation Challenges of Slum Dwellers in Ghana: The Case of Nima Women. *International Journal of Innovative Research & Development*, 3(4), 468-471
- Ige, K.D., and Nekhwevha, F.H. (2014). Economic Deprivation and Willingness to Relocate among Urban Slum Dwellers in Lagos. *Journal of Human Ecology*, 45(1), 25-39, DOI: 10.1080/09709274.2014.11906676
- Joshua, P. and Glanda, G. (2016). Slum Conditions in Urban Nigeria: A Case of Jimeta-Yola, Adamawa State, Nigeria. *Journal of Environment and Earth Science*, 6(3), 74-80
- Krugman, P.R. and Wells, R. (2012). *Macroeconomics* (3rd ed). New York: Worth Publishers
- Mahabir, R., Crooks, A., Croitoru, A. and Agouris, P. (2016). The study of slums as social and physical constructs: challenges and emerging research opportunities. *Regional Studies, Regional Science*, 3(1), 399-419, DOI: 10.1080/21681376.2016.1229130
- Mishra, V. and Banerjee, A. (2020). Socio-economic Deprivation among Slum Dwellers: A Case Study of Migrants in Slums of Allahabad. In A. Banerjee et al. (eds.), *Population Dynamics in Contemporary South Asia*, 179-195, https://doi.org/10.1007/978-981-15-1668-9_8
- Olalekan, B. (2014). Urbanization, Urban Poverty, Slum and Sustainable Urban Development in Nigerian Cities: Challenges and Opportunities. *Developing Country Studies*, 4(18), 13-19
- Oxford Poverty & Human Development Initiative (OPHI), (2019). Background to the MPI. Retrieved online at <https://ophi.org.uk/multidimensional-poverty-index/background-to-the-mpi/>
- Patel, A., Mundt, M., Lee, H., Lotia, H., Rafiq, M. and Malik, A. (2019). Empowering Women in South Asia's Slums: The Challenges of Environmental Degradation, Research Contribution Paper, GrOW Working Paper Series, GWP-2018-17, Institute for the Study of International Development

- United Nations Human Settlements Programme (2015). UN Habitat Global Activities Report. UN-Habitat, Kenya
- United Nations. (2003). The challenge of slums global report on human settlement. Human Settlements Programme, Earthscan Publications Ltd., USA.
- Zadeh, L.A. (1965). Fuzzy sets. Information and Control, 8, 338–353

FOOD SECURITY: AN INFORMETRIC ANALYSIS OF AGRICULTURAL SECTOR IN NIGERIA (2009-2018)

^{1,2*}**Oluwole O. Durodolu and ²Racheal O. Odunlade**

¹Department of Information Science, University of South Africa

²University of Lagos Library, University of Lagos, Akoka, Nigeria

*woledurodolu@gmail.com; rodunlade@unilag.edu.ng

ABSTRACT

This study identifies food security as a pivotal part of national development in Nigeria. Productivity in every other aspect of citizens' life is guaranteed by having access to food daily. More often than not, hunger and malnutrition stem from inadequate food supplies from national, State, household or intra-household level. Adequate research in agriculture can engender agricultural productivity and guarantee food security. This study investigates the impact of communicating scholarly agricultural research conducted in Nigerian universities on national food production. This is an informetric study using a quantitative approach to evaluate information resources generated in agricultural research in Nigeria between years 2009 to 2018. Data were gathered using Meta-analysis to collate various studies in agricultural science within the space of ten years. This collation is limited to publications on the web of science, which is one of the largest subscription-based databases that provide wide-ranging information to many educational disciplines. Prior findings in collated studies were systematically analysed with a focus on measuring the trend of publications by year, the growth rate of research productivity and the visibility of research and researchers, amongst others. Findings revealed that research productivity in the agricultural sector in Nigeria has significantly increased within the years under study. Also, agricultural scholars communicate their research findings to a wider audience by publishing in scientific journals. By implication, communicating Agricultural research output can aid food production and encourage agricultural producers, especially now that the federal government of Nigeria is supporting mechanised farming. This will ultimately reduce the incidences of poverty and help the developmental aspiration of the country.

Keywords: Food Security, Agricultural Research, Nigeria, Informetric, Research Output, Research Visibility.

Introduction

Malnutrition occurs in a circumstance where the necessary beneficial nutrient is lacking in the human diet, or certain nutrient is supplied in excess to the detriment of human health and wellbeing. In the survey carried out by UNICEF (2019), Nigeria was identified as a nation with the second-highest affliction of stunted children globally, with incidence proportion of 32 per cent of children under five, it was also estimated that 2 million offspring in Nigeria are under the

unbearable yoke of acute malnutrition, seven per cent of women of the childbearing category is suffering from susceptibility caused by malnutrition. Consequently, malnutrition has been implicated as the leading cause of the death of 45 per cent of children who are below five years of age. Even though Nigeria is somewhat deficient in the food supply, but it is perhaps better in food production than many countries, in recorded history, it has not suffered a major calamity that could be described as famine, mass starvation or acute food crisis (Ojo and Adebayo, 2012). This, however, should not preclude scholars in carrying out research that will maximise productivity in the agricultural enterprise and prevent food insecurity.

Stimulating agricultural production is anchored on advance agricultural research which necessitates effective agricultural information dissemination in which utilisation of information is fundamental to the growth and developmental efforts and mandatory for effective control, optimal utilisation of resources, and innovation of any nation's agricultural sector. Therefore, efforts should be channelled towards ensuring availability and productive utilisation of information sustainably by creating a facilitating environment indispensable for innovative research efforts. There is a positive correlation between accessibility to information service delivery and agricultural improvement worldwide (Uganneya et al., 2013), hence the need for increased research productivity in the agricultural sector. This study takes a critical look at the online citation analysis of research publications in the agricultural discipline in SCOPUS which is Elsevier's abstract and citation database to assess the impact of communicating scholarly agricultural research conducted in Nigerian universities on national food production.

Objectives

1. To determine the trend of publication by year
2. To measure the growth rate of research productivity of agricultural researchers in Nigeria
3. To examine the distribution of publication enhanced by the institution
4. To investigate the visibility of agricultural research in Nigerian Universities.
5. To examine the trend of research communication among agricultural scholars in Nigeria.
6. To measure the visibility of agricultural researchers
7. To ascertain the trend of collaborations of agricultural researchers in Nigeria with other countries.

Literature Review

Agriculture and Food Security

Food is an essential component of growth and development. Food plays a significant role in the total wellbeing of an individual. Therefore, the provision of adequate food for consumption is germane to the individual's growth and national development. To ensure an adequate supply of the right kind of food, that will shut out malnutrition amongst a people, and food security must be ensured. In 1996, the World Food Summit described food security as the physical, social and economic access to sufficient food that enhances active and healthy life enjoyed by a people. When there is food security, there is little or no fear of starvation. Malnutrition will not be a

threat, and active life is ensured. Where these indices are present, national growth is guaranteed. The essential components of food security include availability, which is the provision of sufficient quantities of appropriate food, accessibility which translates to having adequate income or other resources to purchase available food, and utilisation which is having adequate dietary intake and the ability to absorb and use nutrients in the body (Food & Nutrition Technical Assistance, 2013-2018).

The concept of food security is tightly knit with the agricultural sector. Food is one of the major classes of agricultural produce; therefore, agricultural productivity in terms of the food supply is crucial to food security. Ojo and Adebayo (2012) affirm that though Nigeria has been pretending about its agricultural productivity status, especially with regards to food, yet the nation is far from being completely food secured. This affirmation is buttressed by Matemilola and Elegbede (2017) in their study where the role of agricultural revamping in overturning the food insecurity problems in Nigeria and the coping strategies were highlighted. However, the intervention of USAID's agriculture and food security program has helped to increase agricultural productivity, expand market participation, increase the resilience of vulnerable households, improve the business enabling environment and increase access to finance in Nigeria (USAID, 2019).

In the context of Nigerian environment, infometric evaluation has been done concerning other professions, for instance, in engineering (Durodolu and Ojo, 2018) and medical sciences (Durodolu et al., 2019).

Methodology

Qualitative analysis was conducted using descriptive informetric methods allowing us to analyse research output in Agriculture in Nigeria between 2009 to 2018, harvested from SCOPUS, which is Elsevier's abstract and citation database. The study examined informetric analysis of numerous research publications on agriculture in Nigeria using SCOPUS as a foundation to gather data on accessible publications. The overall records downloaded were 5,164, Sum of Times Cited was 43,285, Without self-citations 40,578 and h-index of 63 average citations per item 8.38. The data analyse limited to 10 leading authors, subject category, affiliation, the trend of research communication, the trend of research collaboration, and informetric growth rate. The result of the acquired information was presented in tables and figures to ensure clarity.

Results

Figure 1: Trend of Agricultural Research Publication by Year

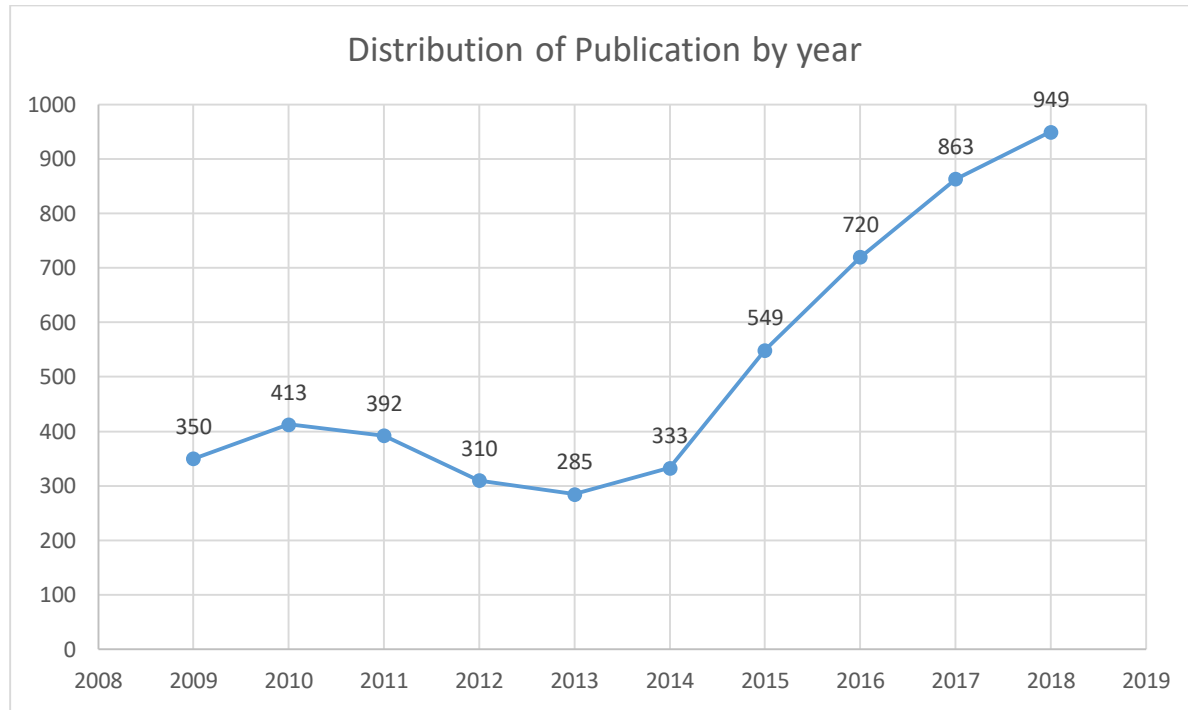


Figure 1 above gave clear evidence of research productivity in agriculture from the year 2009 to 2018 in SCOPUS, and it reveals a systematic increase in agriculture research among top ten Universities in Nigeria except for 2011 to 2014 that witnessed a decline in publications. Obviously, out of the 5,164 research publications within the space of ten years, the research output of the year 2018 remain the highest, which is 949 publications.

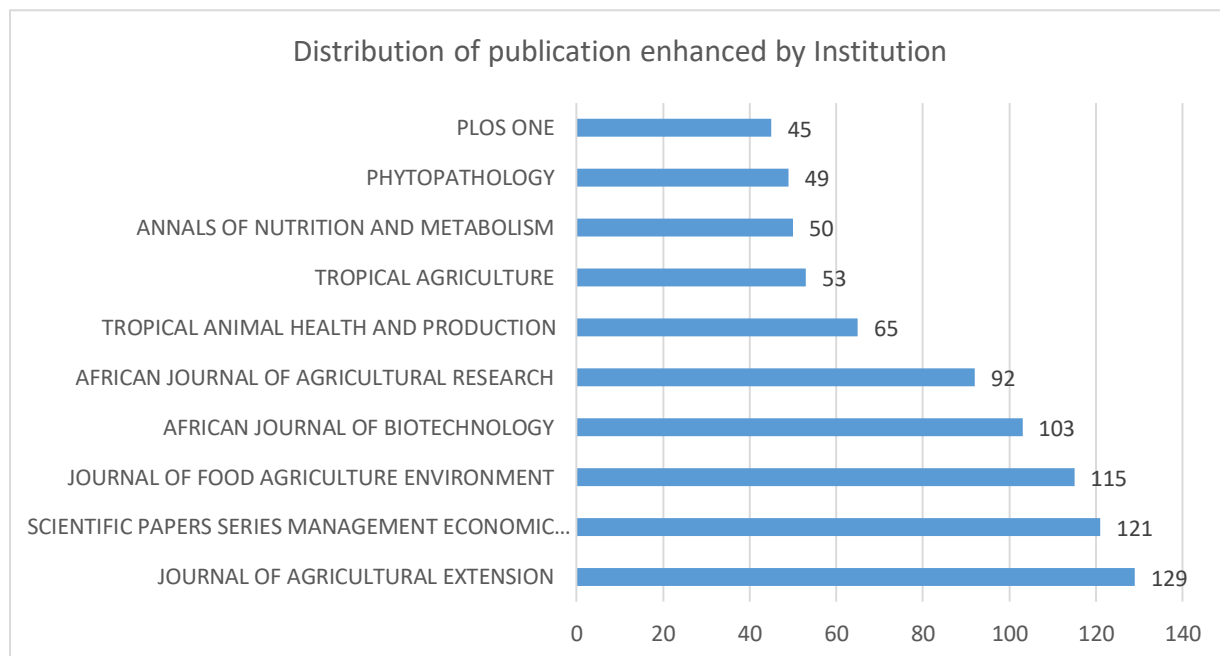
Table 1: The growth rate of agricultural research productivity in Nigeria

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.520428	0.194712	28.35172	0.0000
T	0.116710	0.031381	3.719174	0.0059
R-squared	0.633570	Mean dependent var		6.162335
Adjusted R-squared	0.587766	S.D. dependent var		0.443934
S.E. of regression	0.285030	Akaike info criterion		0.504409
Sum squared resid	0.649935	Schwarz criterion		0.564926
Log-likelihood	-0.522045	Hannan-Quinn criter.		0.438022
F-statistic	13.83225	Durbin-Watson stat		0.636454
Prob(F-statistic)	0.005878			

Source: Researcher, 2019

Table 1 presents a semi-log growth rate model of agricultural research productivity in Nigeria for 2009 and 2018. The Ordinary Least Square (OLS) method of time series regression was used to estimate the model. The result showed that the growth rate of agricultural research productivity is 11.67% between 2009 and 2018, as indicated by the T value of 0.116710. The probability value (0.0059) showed that research productivity in the agricultural sector in Nigeria has significantly increased within the space of ten years. The growth rate was found to be statistically significant at 5% level of significance. Therefore, the researcher is ninety-five per cent confident that the growth rate of agricultural research productivity in Nigeria is sacrosanct. The R^2 value of 0.5877 indicates that 58.8% variation in the growth rate of productivity of agricultural research is accounted by time. The F-Statistic (13.83225, $p=0.005878$) showed that the model obtained is considered useful and worthwhile to predict the future growth of agricultural research productivity in Nigeria.

Figure 2: Distribution of publication enhanced by institution



Distribution of publication enhanced by the institution is presented in Figure 2. This evaluates sources where researchers in agriculture publish as these academic journals serve as an avenue to communicate and exchange view relating to research findings. According to the data gathered, the research output of agriculture researchers in Nigeria are mostly published and became visible in journals of agriculture (5,164 publications). The above sources of publication also represent the ten leading journals indexed by SCOPUS, where Nigerian agricultural researchers published and communicated their research findings within the time frame covered by this research.

Table 2: Visibility of agricultural research in Nigerian universities.

S/N	Field: Organizations-Enhanced	Record Count	% of 5,164	Bar Chart
1	University of Agriculture Abeokuta	1,209	23.412 %	
2	International Institute of Tropical Agriculture	646	12.510 %	
3	University Of Ibadan	573	11.096 %	
4	Michael Okpara University of Agriculture	371	7.184 %	
5	Ahmadu Bello University	313	6.061 %	
6	Obafemi Awolowo University	301	5.829 %	
7	University of Nigeria	287	5.558 %	
8	University of Agriculture, Makurdi	250	4.841 %	
9	Fed. University of Technology Akure	215	4.163 %	
10	University of Ilorin	183	3.544 %	

Table 2 above revealed that University of Agriculture, Abeokuta has the highest number of agricultural research publications (1,209) within the years under study as indexed by SCOPUS.

Figure 3: Trend of research communication among agricultural scholars in Nigeria

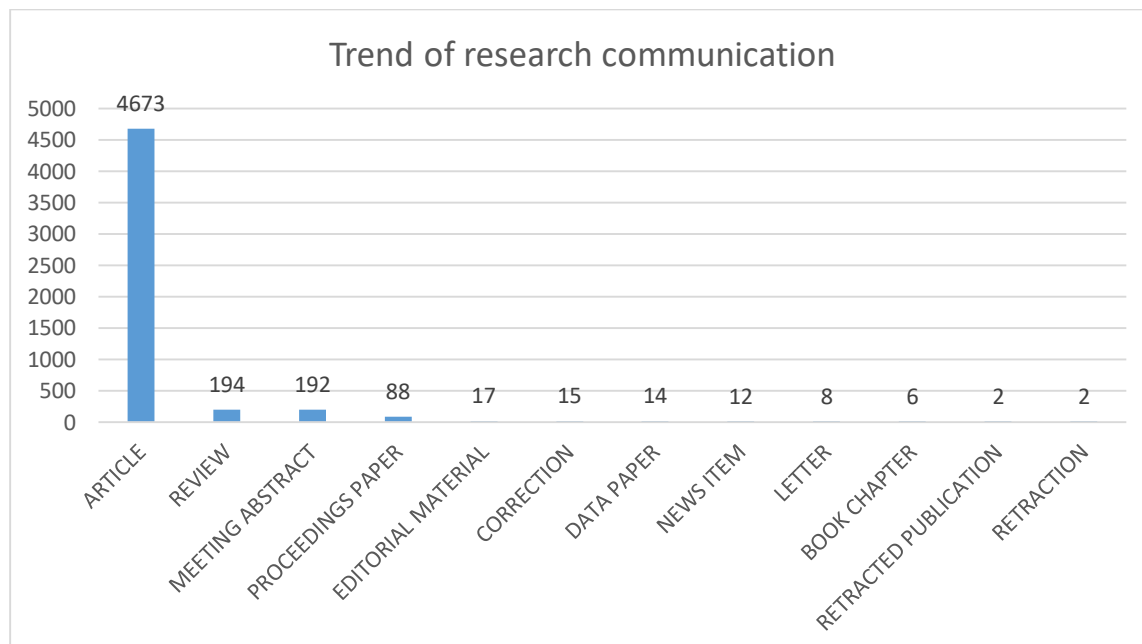


Figure 3 shows the trend of research communication among agricultural scholars in Nigeria within the space ten years as visible in SCOPUS electronic database. The above result shows that most of the researchers in the agricultural setting communicate their findings by publishing in scientific articles. Additional sources of research communication include review (194), meeting abstract (192), proceedings chapter (88), editorial material (17), correction (15), data paper (14), news item (12), newsletter (8), book chapter (6), retracted publication (2) and retraction (2).

Figure 4: Visibility of agricultural researchers

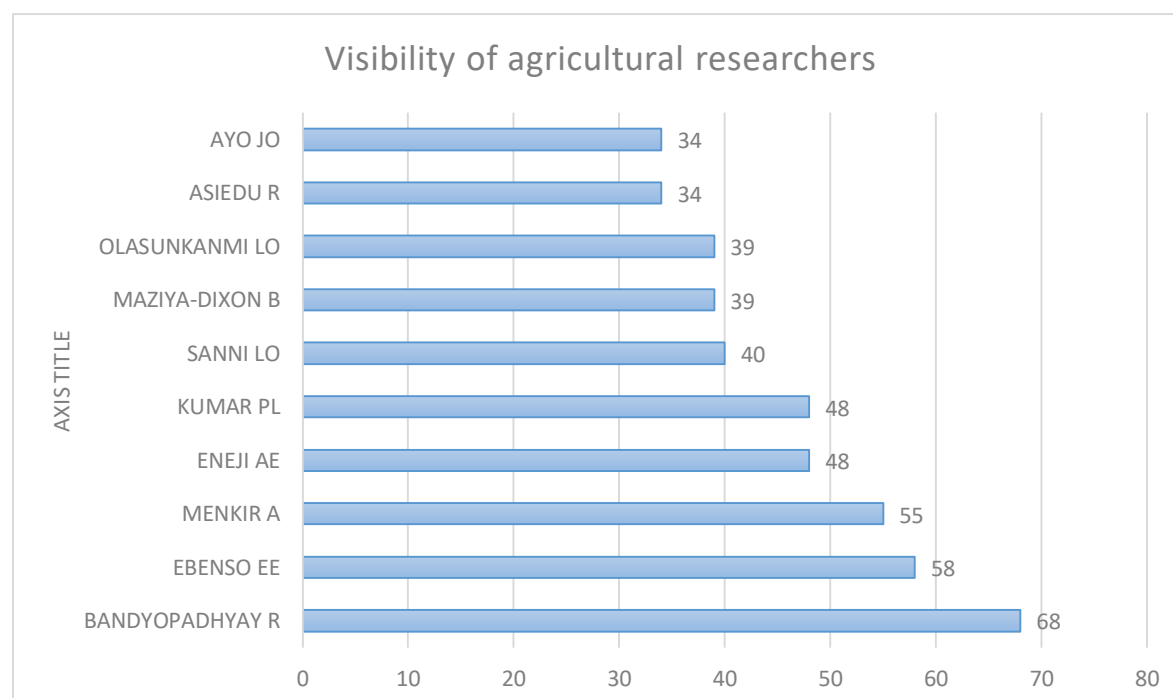


Figure 4 shows the list of the most prolific and visible authors within the space of 10 years in agricultural research in Nigeria. Based on the available evidence of the top ten researchers, Bandyopadhyay has the highest research publications (68) while Ayo and Asiedu have the lowest (34) output each in SCOPUS.

Table 3: Trend of collaborations of agricultural researchers in Nigeria with other countries.

Select	Field: Countries/Regions	Record Count	% of 5,164	Bar Chart
1	Nigeria	5,163	99.981 %	
2	South Africa	534	10.341 %	

3	USA	496	9.605 %	■
4	England	352	6.816 %	■
5	Peoples Republic China	314	6.081 %	■
6	Malaysia	235	4.551 %	■
7	Germany	205	3.970 %	■
8	Ghana	187	3.621 %	■
9	Kenya	181	3.505 %	■
10	India	176	3.408 %	■

From Table 3, it is evident that countries that have the highest collaborative research efforts with Nigeria researchers are South Africa (534) and United States (496). By implication, research collaboration in Nigeria's agricultural space appears below.

Discussion

This paper examined the impact of agricultural research publications on food security in Nigeria. Informetric analysis of research publications on the Agricultural Sector as contained in the SCOPUS database over a period of ten years (2009-2018) was carried out. The study established that there was a geometrical increase in the trend of agricultural research productivity in Nigeria within the years under study. This implies that agricultural research productivity in Nigeria has been highly prolific in the research environment over the period under consideration. Nonetheless, the quality of any research work is adjourned beyond the proliferation of research outputs. Factors such as the number of citation received in the past, current and future journals and impact criteria occupy higher precedence than research copiousness in consideration of the impact of research published on the development of the society.

However, it is glaring that 23.4% of the research output, which represents 8 in every 10 research in Nigeria agricultural space, was produced by University of Agriculture, Abeokuta. This is not surprising. It is only confirmed that lecturers of UNAAB are pulling their weight in the research environment, especially agricultural research, which is their domain. It also implies that other universities where agricultural science is being offered as a program need to come to the limelight. It must be noted that the use of any research lies in its dissemination and this must not be limited to local contents but must be given global dissemination in high impact factor journals. This enhances the visibility of research productivity.

Though the study established that agricultural scholars in Nigeria disseminate their research findings by making their result and scientific reports accessible to a wider audience, their research collaboration with other countries of the world in agricultural space appears low. This is another area of concern. The world has become a global village where collaboration, especially in academia, is the order of the day. Agricultural researchers in Nigeria need to collaborate more with colleagues in other countries. This will not only widen their horizon but will also expose them to agricultural ideas, procedures and practices in other countries, which could be beneficial to Nigerian farmers.

Conclusion and Recommendation

This study concludes that though agricultural researchers in Nigeria are pulling their weights in the global research environment; they need to do more, especially in the area of collaboration with their counterparts in other countries. Therefore, scholars in the agricultural discipline should carry out more research that will maximise productivity in the agricultural enterprise and prevent food insecurity. Provision of agricultural information can catalyse robust agricultural productivity and national development. Because of the ongoing, the following recommendations are postulated:

- This research recommends that there should be specific disbursement or concession from government to stimulate higher research output or investment in Agricultural research.
- Tertiary Education Trust Fund (TETFUND), is an initiative established by the Federal Government of Nigeria, to promote educational development in all the government-owned higher institution. This organisation should mandatorily dedicate a higher percentage of their fund to helping Agricultural research to promote food security in the country.
- More visibility should be given to researches in Agricultural science so that the output of the research will reach the general public

References

- Durodolu, O.O. and Ojo J. O. (2018). Informetric Growth Analysis of Engineering Research in Nigerian Universities, 2007 - 2016 Survey. *Journal of Applied Information Science and Technology (JAIST)* Vol. 11 (1).
- Durodolu, O. O., Adeleke, A.A. and Ojo, J.O. (2019). Infometrics Growth Analysis of Medical Science Researchers in Nigeria during 2007 to 2016. *DESIDOC Journal of Library & Information Technology*, Vol. 39, No. 5, pp. 244-250, DOI: 10.14429/djlit.39.5.14494
- Food & Nutrition Technical Assistance (2013-2018). Food Security. Available @ <https://www.fantaproject.org/focus-areas/food-security?page=1> Retrieved 09/08/2020
- Matemilola, S. and Elegbede, I.O. (2017). The Challenges of Food Security in Nigeria. *Open Access Library Journal* 04(12):1-22. DOI: [10.4236/oalib.1104185](https://doi.org/10.4236/oalib.1104185). Available @ <https://www.researchgate.net/publication/321939403>
[The Challenges of Food Security in Nigeria Retrieved 22/08/2020](https://www.researchgate.net/publication/321939403)

- Ojo, E.O. and Adebayo, P. F. (2012). Food Security in Nigeria: An Overview. European Journal of Sustainable Development, Vol.1 (2); Pp.199-222
- Uganneya, S., Ape, R. and Udensi, J. N. (2013) Agricultural Research Information System of Nigeria: An Assesment of Institutional Effectiveness. Library Philosophy and Practice (e-journal). 998. Available @ <https://digitalcommons.unl.edu/libphilprac> Retrieved 17/01/2020
- UNICEF (2019). Nutrition.Available @ <https://www.unicef.org/nigeria/nutrition> Retrieved 17/01/2020
- USAID (2019). Agriculture and Food Security. Available @ <https://www.usaid.gov/nigeria/agriculture-and-food-security>. Retrieved 22/08/2020

TAMING THE NATURE AND SAVING THE EARTH: SYNERGY BETWEEN ISLAM AND SCIENCE

Abdul-Raheem B.

Department of Religious Studies, Faculty of Arts, University of Lagos
babdul-raheem@unilag.edu.ng

ABSTRACT

In the recent times, the existence of man on the surface of the earth is being threatened by the devastating and violent natural disasters with manifestation of hurricane, floods, earthquake, volcanic eruptions, landslides, and wildfire etc. Evidently, these natural disasters claim millions of lives annually with the attendance of wanton destruction of properties worth billions of dollars. In spite of concerted efforts put in place by various governments to contain the menace especially in the countries that are prone to these disasters, permanent solution is yet to be proffered. The purpose of this study is to establish the extant of synergy between Islam and Science especially on the issue of nature. Historical research method was employed to examine the history of causes and solutions of natural disasters in the Qur'an. The results revealed that there is history of past generations who suffered the effects of natural disasters. It was also revealed that, according to the Qur'an, the main cause of these natural disasters was the failure of those generations to recognise the existence of the Creator and obey His instructions. Finally, from Islamic perspective taming the nature is a phenomenon that is realisable. It was therefore recommended that to achieve permanent solution there is need to recognise the existence of the owner and the maker of the nature from whom the man can derive the power to tame the nature. Furthermore, there is need to consider divine information in providing solutions to the issues of natural disasters. Lastly, prayer is a potent tool in curbing the occurrence of natural disasters. In conclusion, science might not have information on how to tame nature but definitely Islam has it at its disposal. Hence, the only obstacle is how ready man is to abide by the condition attached to it.

Keywords: Islam, Science, Nature, Natural Disasters and Man

Introduction

The earth as a member of planetary system is regarded as the only planet which serves as habitation for all living things. Though it is part of nature, others such as the sun, the moon, the air, the mountains, the seas and rivers, the vegetation, and the precipitations etc. are great determinants for the survival of mankind. The great task ahead of man is the exploration of these natural phenomenon for his continuous survival. To fully explore the nature there is need for

knowledge which is science. According to the UK's Science Council, science is defined as "the pursuit and application of knowledge and understanding of natural and social world, using a systematic methodology based on evidence". This definition reveals the relevance of science in exploring nature. It is an undeniable fact that through science a great deal of discoveries had been made which contribute immensely not only to the meaningful exploration but to overcoming the challenges posed by nature. Nevertheless, the limitation of science lies in its inability to help the man taming nature when it goes ferocious. It must be emphasised that the world has been experiencing devastating effects of global warming which is taking its toll on human and material resources. Despite the efforts made through the application of science to put a halt to the menace of global warming, the desired results are yet to be achieved. To have permanent solution there is need for ability to tame the nature the fact that is not within the purview of science.

However, the source of information in Islam is the Glorious Qur'an. The uniqueness of this information is that it is incontrovertible whether it is about natural or social world. What gives credence to this is the fact that 1441 years ago there is no record of refutation whatsoever against the information provided by the Qur'an on any subject matter up to this moment unlike science that is characterised by constant refutation of theories. Interestingly, the Qur'an provides detailed information about various forms of nature with focus on two objectives. First, the Qur'an talks about the nature so that man can acknowledge that the nature has the Creator; Q6:102, Q13:16, Q31:11. Second, the nature was created for the service of man, in enjoying the service man should, in return, render service to the Creator of the nature Q14:32-34. The pertinent question is; does the Qur'an give information on the possibility of man's ability to control the nature?

Justification for Extant of Synergy between Islam and Science

Religion and science are seen as two parallel lines by some people on the premise that science deals with factual information while religion is characterised by fantasy. In addition, the antagonism between the scientists and church is another point argued for. During 16th and 17th centuries, Nicholas Copernicus and Galileo Galilei were two scientists who suffered the persecution of Catholic Church priests on the account of their heliocentric theory which goes against the belief of church that the earth is the centre of the universe. The books written by these scientists were banned and they were declared sinners which warranted their inquisition (Leviellee, 2011). This notion to some extent might be difficult to fault in relation to other religions but as regards Islam it might be regarded as mere conjecture. The reason for this is that the Qur'an which serves as source of information in Islam shares many similar things with science. The nature of science is that it deals with hypothesis, gathering of data and experiment which makes information given by science reliable. Hassan (2013) avers that science can be approached in two dimensions; epistemological and ethical dimensions. According to him ethical dimension of science deals with the application of scientific knowledge which results into the production of techniques and technological products. He submits that there is possibility that science can stand for either of the two or both.

The epistemological dimension of science which deals with knowledge of everything is a point of intersection between Islam and science. The system of epistemological dimension of science is the use of hypothesis, making observation, gathering of data, and carrying out experiment and formulation of theory. With this method science delves into any subject matter be it natural world, human being, animals, plants, or concrete objects. Everything that science considers worthy of study Islam has drawn man's attention to them for the purpose of reflection over their existence.

Observation is an important element in the science because it helps in the discovery of some fact about the object of study. Similarly, there are two terms used in the Qur'an which are equivalent to the word "Observation" and they are "*Itabara*" and "*Nazara*". These two terms were used for the purpose of arousing the consciousness of man to study and reflect about everything around him and thereby acknowledge the existence of their maker. Some examples will suffice in this discourse to drive home the point.

"Then let mankind look at his food. How We poured down water in torrents, then We broke open the earth, splitting {it with sprouts}" (Q80:24-26). The word "*Nazara*" is used here in imperative mood which implies that mankind is asked to observe the process of plants germination. This can be referred to as science of plants or Biology.

"So, let man observe from what he was created. He was created from a fluid, ejected, emerging from between the backbone and ribs (Q86:5-7)". This can be referred to as science of embryology.

"Then do they not look at the camels- how they are created? And the sky- how it is raised? And at the mountain -how they are erected? And at the earth -how it is spread? (Q88:17-20)". The fields of science alluded to in these verses are; Zoology, Astronomy and Geology.

Nothing makes scientific information more reliable than the performance of experiment. Therefore, the purpose of experiment is to establish a certainty about a certain concept which has been hypothesised. In the same vein, two instances were recorded in the Qur'an to justify the import of experiment in establishing a certainty. Two examples were given in Q2:259-260. The experiment was on the concept of resurrection. The material used in the first case was donkey while in the second case four different birds were used and at the end of the experiment the two people involved confirmed the certainty of resurrection.

Islam and Nature

"Nature means the physical world, that is, the world with which we come into contact through our senses" (Golshani, 1986:81). The bone of contention between theism and atheism is that the former believes that the nature has maker while latter denies ascribing the existence of nature to any maker. To settle the score, there is need for genuine and reliable information and by nature the information must come from above. Undoubtedly, the Qur'an sufficiently discusses the nature to the extent that more than 750 verses of the Qur'an make reference to natural

phenomenon (Golshani, 1986:47). For instance, the heaven was mentioned 312 times, the earth 482, the sun 32, the moon 27, the stars 13, the sea 41, the precipitation 38, the river 54, the day and night 50, the mountain 6 especially where it was mentioned as peg that holds down the earth and the wind 27 (Source: *al-Mu'jam al-Mufahris li alifāz al-Qur'an al-Karīm*).

The scholars unanimously agree that the Qur'an is not in any way a book of science despite the fact that it contains scientific information rather it is a book of guidance for the entire mankind. Golshani (1986) identifies some reasons for finding information about the nature in the Qur'an.

First, inclusion in the Qur'an the discourse on the nature is to afford the mankind the opportunity of studying the secrets, wonders, causes and effects, and the system by which the nature functions with objective of seeing them as the sign of existence of omniscient designer and programmer. Such information is contained in; Q3:190-191, Q29:20, Q50:6-8, Q51:20-21, Q88:18-21, etc.

Surely in the creation of the heavens and the earth and the alternation of night and day and the ship that runs in the sea with profit to men, and the water God sends down from heaven therewith reviving the earth after it is dead and His scattering abroad in it all manner of crawling thing, and the turning about of the winds and clouds compelled between heaven and earth, surely there are signs for a people having understanding. (Q2:164)

Volumes of books had been written by scientists on the structures, effects, functions and inter-relatedness of each type of nature mentioned in the above verse of the Glorious Qur'an. Therefore, the study of nature by the scientists is just a response to the divine clarion call. However, the missing nexus between the divine clarion call and the study of scientists is the denial of recognition of the nature's maker. Whereas it will be regarded as futile exercise to study the trace without giving due attention to the tracer.

Second, the quest into the origin of natural world has been the preoccupation of scientists and philosophers. There were lot of speculations about the origin of natural world but these conjectures have been put to rest by the information obtained in the Qur'an about the origin of natural world such information is contained in different pages of the Qur'an among which include the following; "Do they not see how God originates creation, then reverts it back?" (Q29:19).

As regards the origin of heaven and the earth the Qur'an gives the following information;

Do not these unbelievers see that the heavens and the earth were an integrated mass, then We split

them and made every living thing from water? Will they not believe even then? (Q21:30)

The information given by the Qur'an is what the scientists refer to as Big Bang. The Qur'an goes further to give information about the period as well as material in which the heaven was made of as expatiated in the following verses; "And He it is Who created the heavens and the earth in six periods and His Throne of Power is ever on water..."(Q11:7). If it has been proved scientifically that every living thing was created from water and according to this verse the Throne of Power of God stands on water it is logically acceptable to state that man and the natural world were created by God. Ali (2002) explains that; "Man is the highest developed form of life, and life is due to water. The great power of God which is manifested in the creation of man is thus connected with water".

As regards the materials in which the heaven was made of, the Qur'an enunciates thus;

"He then directed Himself to the heaven and it was a vapour, so He said to it and to the earth: Come both, willingly or unwillingly. They both said: We come willingly" (Q41:11).

It is noteworthy that apart from the fact that the heaven was made of smoke both the heaven and the earth are subject to Divine law which means that the natural world functions according to law. Ali (2002) submits that; "Everything created, whether in the heavens or in the earth, is subject to law. The existence of one law throughout the universe is clear evidence of the existence of God, the Maker of that law".

Third, lack of certainty about the origin of natural phenomenon perhaps is responsible for arriving at conclusion that its existence is by accident. However, considering the system and grandeur by which the nature works it will reject the assertion that its existence is by accident. For the purpose of clearing the ambiguity, the Qur'an enjoins mankind to study the perfect orderliness and coordination upon which the nature functions and discover through that the work of wise Creator. Information on this is contained in the following verses;

And you see the mountains, thinking them rigid, while they will pass as the passing of clouds. {It is} the work of Allah, who perfected all things. Indeed, He is Acquainted with that which you do(Q27:88).

Who created seven heavens one upon another. You see no imperfection in the creation of the Beneficent God; then look again, can you see any disorder? Then return back the eye again and again, your look shall come back to you dazzled, weary (Q67:3-4)

Other verses are; Q15:19, Q25:2, Q39:5 and Q21:16.

Fourth, according to the Qur'an, one of the purposes of man's creation is to manage the earth for his betterment and improving the condition of his environment. In view of this he was given the appellation of vicegerent. Evidently, the natural world has been maximally explored by man through the means of science and technology. Triumph of man over the subjugation of the natural world therefore is by the knowledge of God as being indicated in the several pages of the Qur'an.

And He subjected to you the night and day and the sun and the moon; and the stars are subjected by His command. Surely in that are signs for people who understand. And that which He has multiplied for you in the earth of diverse hues. Surely in that is a sign for a people who remember. It is He who subjected to you the sea that you may eat of it fresh flesh, and bring forth out of it ornaments for you to wear; and thou mayest see the ships cleaving through it; and that you may seek of His bounty, and so haply you will be thankful. And He cast on the earth firm mountains lest it shake with you, and rivers and ways; so haply you will be guided; and waymarks; and by the stars they are guided (Q16:12-16).

Other verses include; Q31:20, Q45:13, Q43:12-13, Q6:166 etc.

Frankly speaking, in addition to its primary objective, the Qur'an can be best described as manual for scientists because the discoveries of scientists about the natural world are in consonance with the information given by the Qur'an. However, the missing nexus is that the objective that Islam wants to achieve by inviting man to study the natural phenomenon is for the purpose of recognising the existence of the Creator and to sensitise and give direction to man about the exploration of the natural world. Finally, to provide answers to some intriguing questions that man would likely to ask about the natural world. Actually, science has also been defined as "a way of asking question about the natural world and obtaining a precise answer for them". Indeed, the Qur'an has provided answers to some questions concerning the natural world. For instance, the origin of universe, the origin of man, the purpose of alternation of day and night etc.

The Need for Saving the Earth

It has become a yearly affair that certain parts of the world experience various forms of natural disasters. Hurricane, floods, and earthquake are the most devastating natural disasters because their occurrence claims thousands of lives and destroys properties worth billions of \$US. Countries like China, the United States of America and Cuba are regarded as the most affected countries by hurricane. From 1970 till date, China, the United States of America and Cuba had experienced the total number of 127, 63 and 79 hurricane disasters respectively (Nick, 2017). Hurricane is caused by the collision of masses of warm and moist air which rises from ocean with masses of cooler air (Madaan, n/d)

Majorly, heavy rain especially if it lasts for several days is a contributory factor for flooding. Although the scientists have identified other factors such as degradation of soil which makes it increasingly difficult for the land to absorb water (Sawas, 2019). Floods have become perennial disaster ravaging many countries in the world accompanied with wanton destruction of lives and properties. According to International Disaster Database, in 2010 the total number of people displaced by flooding was estimated to be 178 million with total loss exceeded \$45 billion (Benjamin, 2017).

Earthquake is a detectable shaking of the Earth surface, due to the abrupt release of energy in the crust of the earth which generates seismic waves (Choudhury, Saha and Verma, 2016). The incident of earthquake has become a recurrence decimal for several decades. Its occurrence causes untold damages to human and material resources. Oishimaya (2019) listed about eight countries that are most affected by earthquake among which are; China, Indonesia, Iran, Turkey, Japan, Peru, the United States, Italy among others. Between 1900 and 2016, China has witnessed nothing less than 157 incidents of earthquake which makes it to be ranked as number one out of the most affected countries. The least out of them is Italy which has witnessed 33 incidents of earthquake.

No one is left in doubt that the aftermath of the natural disasters is a threat to human existence. Consequently, efforts have been made every now and then on how to contain the incident of natural disaster in our society. Unfortunately, their serial occurrences show the incapability of man to tackle this menace. Actually, the scientists cannot be denied the credit of studying the nature nevertheless the wisdom of controlling it remains elusive. Therefore, what scientists have been successfully doing is to give preventive measures so as to minimise their devastating effects. However, the inability of scientists to come up with permanent solution does not mean the end of the road. There is need to look beyond the nose in finding lasting solution if the earth must be saved.

The Possibility of Controlling the Nature

One of the areas of interest of Islam is the interaction of man with the nature. According to the Qur'an, the nature is subjected to the service of man while man is mandatory to serve the owner

and the controller of the nature in return(Q14:33, Q16:12 and Q31:20). The belief in Islam is that the nature has the controller which implies that the controller can be appealed to when the nature goes amok. As a matter of fact, from the time immemorial, human society had been inflicted with catastrophe of natural disasters. The Qur'an gives the account of the worst natural disasters in human history. This take place during the era of prophet Nuh where the heaven was opened for unstoppable rain and the springs gushed out from the earth, consequently the entire community was submerged for lengthy period of time (Q54:11-12). The Qur'an also gives account of another community that was ravaged by the most catastrophic hurricane which lasted for about seven nights and eight days and it brought about the destruction of the entire community(Q69:6-7). The main reason for the occurrence of these natural disasters is the denial of existence of the controller of the nature. The Qur'an confirms that had it been these people affirmed the existence of the controller of nature they would have been protected against any natural disaster (Q7:96). With this information, the Qur'an stands as reliable source of information for understanding the possibility of controlling the nature.

The criterion for the nature to be controlled by man is a strong faith in existence of God and obedience to His law. The people with strongest faith are the prophets and messengers of God, next to them are the righteous people. The information gathered in the Qur'an shows that the prophets were given the opportunity of controlling nature. Prophet Musa (Moses) will be used as an example.

Prophet Musa together with the children of Israel fled Egypt fearing the persecution of Pharaoh. The only escape route was to cross to the other side of the sea which was impossible without a means of crossing. In this emergency situation, Prophet Musa, having been inspired by God, displayed the ability of controlling the nature by creating a path in the sea through the use of his staff and thereby crossed to the other side of the sea with the children of Israel. Having achieved the objective, the sea closed back (Q20:77 and Q26:63).

In another circumstances, prophet Musa together with the children of Israel suffered a severe dehydration while they were journeying in the desert. Having taken the instruction from God, prophet Musa stroke the rock with his staff and twelve holes opened gushing out with water because the children of Israel were twelve nations (Q2:60). This is a tip of iceberg of how the prophets of God controlled the nature in the hours of exigency.

Salatul-Istisqā' is a prayer observed for seeking rain when there is a severe drought. This was practised by prophet Muhammad and it continues to be practised by the Muslims. *Salatul-istisqā'* was frequently performed by the Prophet and in one of the occasions it rained for six days and when it became too much people requested that the Prophet should pray for its stop (Sahih Bukhar Hadith 1013).

Due to the severe drought caused by high temperature of 42°C, and 108°F, *salatul-istisqā'* was performed in Sydney, Australia in 2003 to mitigate the effect of severe temperature (Cosgrave, 2003). Similarly, in January 2020, another *salatul-istisqā'* was performed by Muslims joint by

the Christians in Bonython Park in Adelaide, Australia to seek rain due to the worsening drought and bushfire crisis (Mazzoni,2020). This is the practice in other several drought-prone countries especially when there are Muslims and this is the method the Muslims recourse to when there is need to control the nature.

Islamic history recorded an interesting scenario as regards the nature control. The advent of Islam in Egypt put a stop to certain cultural practices especially the anti-Islamic ones. One of such practices is the use of a virgin lady as sacrifice for River Nile every year. When the people of Egypt noticed that River Nile was not flowing as it is used to be the whole Egypt was gripped by panic. When the case was brought to the notice of the then leader of Muslims, Umar ibn al-Khattab, his response to the incident beat the imagination of everybody up to this moment and as result it became a reference point in Islamic history. He only wrote a letter addressing River Nile as if it was human being and the contents of the letter goes thus;

From Allah's humble servant, 'Umar ibn al-Khattab, the Commander of the Faithful, to Egypt's River Nile, if you flow on your own, do not continue flowing. Yet, if you flow according to Allah's will, I pray to Allah, the One the Conqueror, to cause you flow (Muhammad and Abu Al-Yazid: 161-162)

It was reported that in the following day the Egyptian people were surprised to see River Nile overflowing its bank for a distance of 16 cubits. This is how the life of virgin ladies in Egypt was saved and the custom was totally eradicated.

It must be noted that historical evidence helps a lot in finding solution to contemporary issues because it provides relevant clues on how to tackle the current situation. Just like a lawyer who relies on precedents to prove his case or like a medical doctor who relies on past medical reports to diagnose his patients. In view of this, it means that all the aforementioned scenarios can be considered as evidence for possibility of controlling the nature when there is need to save the earth.

The ability or possibility of man to have control over the nature only requires the belief in the existence of the Creator Who is the Owner of the nature and this is what distinguishes religion from the science. Even other religions believe that the nature has Owner which makes their adherents to placate whenever the nature is angry. This is what brings about the idea of sacrifice in African Traditional Religion. Science is yet to make the feat of taming the nature in any form.

In the final analysis, this study has been able to establish the fact that science shares the same interest with Islam in studying the nature though Islam does give minute details as science does. However, the objective set by Islam in studying the nature is different from that of science because Islam bases the studying of nature for realising the existence of God. It is therefore

advisable that science should not be seen as the sole provider of solutions to either human or natural disasters, religion should also be given a chance to play its role.

References

- Abdul-Bāqī, *Al-Mu 'jam al-mufahris lialfāz al-Qur'an*. Dārul-Hadith, 2001.
- Ahmad, Jamil. *Hundred Great Muslims*. Ferozsons Ltd, 1977.
- Ali, Muhammad. *The Holy Qur'an with English Translation and Commentary*. Ahmadiyya AnjumanIsha'at Islam Lahore Inc., 2000.
- Beauchamp, Nick. "Countries most Affected by Hurricane" August 29, 2017. <https://borgenproject.org/countries-most-affected-by-hurricanes/>
- Benjamin, Elisha S. "Countries Most Prone to Urban Flooding". *WorldAtlas*. March 8, 2019. www.worldatlas.com/articles/countries-with-the-most-largest-low-lying-land-urban-area.html
- Choudhury, Mainak, Puma, Saha., and Verma, Sajal. "Effects of Earthquake on the Surrounding Environment: An Overview." December, 2016. www.researchgate.net/publication/316968651
- Cosgrave, Paul. "The performance of Salat-ul-istisqā', the Islamic Prayer for rain, in the Parched bed of Goulburn River in Denman, in the Hunter Valley". Canberra: National Library of Australia. 19 January 2003. <https://nla.gov.au/nla.obj-147380647>
- Golshani, Mehdi. *The Holy Qur'an and The Science of Nature*. Islamic Propagation Organisation, 1986.
- Hassa, Aariz. *A Concise History of Islam*. Random Publications, 2013.
- Leveille, Nicholas P. "Copernicus, Galileo and the Church: Science in a Religious World". 2011. www.inquiriesjournal.com/articles/1675/copernicus-galileo-and-the-church-science-in-a-religious-world
- Madaan, Sonia. "What are Hurricanes?" www.eartheclipse.com/natural-disaster/causes-and-effects-hurricanes.html
- Mazhar-ul-Haq. *A Short History of Islam*. Book Land, 1990.
- Mazzoni, Alana. "Australian Muslims join Christians in a Public Prayer for Rain in Bushfire and Drought-ravaged areas". Mail online. Wednesday, August 26 2020. <https://www.dailymail.co.uk/news/article-7852909/Muslims-pray-rain-Bonython-Park-Adelaide-amid-bushfire-drought-crisis.html>
- Muhammad, Tamir. A. and Abu al-Yazid, Noha. K. *Biographies of the Rightly-Guided Caliphs*. Dar al-Manarah, 2001.
- Osihimaya, Sen Nag. "The World's 10 Most Earthquake Prone Counties". *World Atlas*. April 11, 2019. <https://www.worldatlas.com/articles/the-world-s-10-most-earthquake-prone-countries.html>
- Philip, Hitti. K. *History of the Arabs*. Palgrave, 2002.

Reference. “What is the importance of science in everyday life?”. April 1, 2020
www.reference.com/science/importance-science-everyday-life-
Sawas, Amiera. “Why Countries Around the World Experiencing More Floods”. September 25,
2019. [www.actionaid.org.uk/blog/news/2019/11/25/why-are-countries-around-the-world-](http://www.actionaid.org.uk/blog/news/2019/11/25/why-are-countries-around-the-world-experiencing-more-floods)
[experiencing-more-floods](http://www.actionaid.org.uk/blog/news/2019/11/25/why-are-countries-around-the-world-experiencing-more-floods)

SCIENCES

NATURE INSPIRED INNOVATIONS, THE PANACEA FOR OUR AILING AND DISTRESSED PLANET EARTH

Ajayi T. O.

Department of Chemical Engineering

University of Lagos

Akoka -Yaba

tajayi@unilag.edu.ng

ABSTRACT

As human population continues to increase, increase in industrial production to meet the growing population's demand leads to scarcity of resources and pollution of the environment that is meant for man's survival. The earth is distressed and ailing, and man might self-destruct if we continue with business as usual. The only way out of this quagmire man has gotten himself into is to look at how nature has survived for 3.8 billion years and learn. Nature-inspired innovations, aka biomimicry, seems to be the only strategy for the long-term survival of planet earth. This paper looks at how the earth got to its present predicament, explains what biomimicry is about, and discusses the principles that has ensured nature's sustainability for all these years. Examples of applications of biomimicry in architecture, communication, energy efficiency, materials, medicine, optimization, product and process designs are given and how biomimicry can be implemented in innovation and design is discussed. The paper concludes with the need to integrate biomimicry into the science and engineering curricular so as to help students, who are the engineers of tomorrow's earth, cultivate more environmentally friendly and sustainable designs and products.

Keywords: Innovations, Nature-inspired, Biomimicry, Sustainability, Environment.

INTRODUCTION

“The world we have made, as a result of the level of thinking we have done thus far, creates problems we cannot solve at the same level of thinking at which we created them.” - *Albert Einstein*. “Nature is the source of all true knowledge. She has her own logic, her own laws, she has no effect without cause nor invention without necessity.” - *Leonardo DaVinci*. These words from the physicist Albert Einstein and polymath Leonardo DaVinci strike a strange but essential paradox in our pursuit to save planet earth.

Nature, the physical world around the earth, is made up of the biotic (plants, animals, humans) and the abiotic (the environment around us: air, water, and land). The biotic

components of planet earth have survived by breathing air, drinking water, and eating food obtained from the land. Man had a good relationship with nature, but as time progressed, there was a change in relationship, man started to exploit and manipulate nature. A number of revolutions have caused a change in man's relationship with nature: the agricultural revolution, the scientific revolution and the industrial revolution (Emmott, 2013). Man gradually transited from the hunter/gatherer to the mechanised farmer, and with the industrial revolution came the use of pesticides, fertilisers, crossbreeding and genetic engineering into agriculture. Some researchers are of the opinion that man tampering with animals, in the name of genetic engineering, brought about the coronavirus, which is responsible for COVID-19 (Cyranski, 2020). In the scientific revolution, man discovered nature and could explain the workings of nature by using the principles of science (mathematics, chemistry, physics, and biology) and came up with a wide variety of scientific development, most of which exploited nature. With the industrial revolution, handmade items were now mass produced in industries, and industries were now as varied as they were as diverse. The transportation industry transited from horses, canoes to steam engines, and now there exist a wide variety of transportation. In our advancement of transportation, we have also created a highly efficient network for the global spread of diseases such as COVID-19, that started in Wuhan, a city in Eastern China. There is indeed no limit to man's ingenuity. As man enters the next revolution, the robotic revolution, only time will tell the consequences of this next move. Science, indeed, has helped man to explore, exploit and manipulate nature, but it has also failed man; man impacted nature negatively and nature is now distressed and affecting man negatively.

Science has helped in discovering how things work and engineering has used this to provide innovative solutions to the problems man faced as he learnt to live on earth. But as time progressed man's inventions were no longer in tandem with nature and man started to destroy the same earth that sustains him. Industries exist to provide services and make products that man needs/wants in order to make planet earth a comfortable place to dwell in. These industries extract raw materials from the environment, at a rate faster than it can be replenished, and often pollute the environment during exploitation and processing of these raw materials. During processing a lot of 'unwanted substances' called waste, which tends to be inimical to the environment, are discharged into air, water and land. When products are of no use or have become obsolete, they are also disposed of to the land. All these discharges are harming our environment: increase in CO₂ from transportation and industry is giving rise to global warming with its attended problems of floods, heatwaves, fires, sea-level rise, change in agricultural pattern; air pollution is affecting human health with diseases such as cancer, respiratory, cardiovascular, and neurological diseases, and destroying the ozone layer that keeps the harmful ultraviolet rays of the sun from reaching earth. Plants and animals are not left out of the effect of environmental pollution.

Man's approach to his activities on planet earth seem to be opposed to how the natural world works. Like water flowing down a path, nature chooses the path of least resistance. But not so with man's activities, most of which are an uphill task with associated environmental

pollution. The environment's self-cleansing mechanism has reached saturation and the environment can no longer cope with all of man's exploitation and discharges to it, this has led to our planet earth being distressed. As man draws survival from planet earth, whatever befalls the earth, directly or indirectly befalls man. To save planet earth we must change our ways of doing things, there must be a paradigm shift in the way we relate with our planet earth.

The activities man undertakes for his survival on planet earth is also being undertaken by the plants and animals that he shares the earth with. The natural world, undisturbed by man, is orderly and full of patterns that can be adopted/adapted in the design of products and processes that man needs to live on earth. Nature has this unusually simple technologies and innovations of solving some of the world's complex challenges (Aziz and El Sherif, 2016). Nature has had 3.8 billion years of experience (Benyus, 2002), and as experience is the best teacher, man can study how nature works and be inspired by her for innovation, this is the paradigm shift needed by man to save planet earth.

NATURE INSPIRED INNOVATIONS

The idea of copying from nature is not new as before the industrial revolution, man's inventions mimicked nature: the Indian rock-cut architecture mimicked the caves the early man dwelt in, the Chinese learnt to make silk by observing the silkworm, the Egyptians were inspired by mountains to build pyramids, the umbrella was inspired by children using lotus leaves for rain shelter, and Leonardo Da Vinci studied bird flight and designed the flying machine, from which the Wright brothers constructed the first aircraft, which flew in 1903. The revolutions that have happened over the years have had tremendous benefits for man, but not so for the earth, nature has suffered from our revolutions: resource depletion and environmental pollution. Going forward, in order to save our planet earth, there is the need for our innovations to be inspired by what has been tested and found to be sustainable – the way nature works.

Janine Benyus (Benyus, 2002) coined the word "biomimicry" for nature inspired innovation; it is the study of nature's forms and functions in order to draw inspiration to use in designing innovative engineering solutions in solving man's challenging problems. The term biomimicry, coined from two Greek words *bios* (life), and *mimesis* (to imitate) literally means "to imitate life".

Benyus, based on her decades of studying nature, came up with some basic laws of nature, but because nature is too diverse to be generalized into laws (Marshall and Lozeva, 2009), they are referred to as the core principles that guides nature's operations and can be sources of inspiration for man's innovations.

Nature's Design Principles

Since nature has been around for such a long time, what are the principles that have guided her all these years?. The only way forward for our distressed planet is to learn these principles and inculcate them into the design of our services and products.

- Nature runs on sunlight – source of power/energy is ‘freely’ available, found locally, and renewable;
- Nature uses only what is needed – does not take from the environment as much as is wanted, but only what is needed, it seeks to optimise rather than maximise;
- Nature fits form to function – the purpose/activity determines shape, that is function determines form or form follows function;
- Nature recycles everything – finds a use for everything, so waste does not exist, it closes the cycle within the whole ecosystem.
- Nature rewards cooperation – does not exist in isolation, takes from and gives to another organism present, communal and beneficial relationship;
- Nature banks on diversity; – has a wide variety of plants and animals, the multidisciplinary nature of its function and activities to meet a need gives nature its resilient characteristic.
- Nature demands local expertise - works in tandem with what is available in the local environment and does not import;
- Nature curbs excess from within – does not create unnecessary materials;
- Nature taps the power of limits – identifies limits and sets boundary for a feasible solution based on life-friendliness (using safe materials and processes with safe operating conditions conducive to life, such as, ambient temperature and pressure);
- Nature runs on information – in order to adapt to their environment, organisms send, and receive information from one another and from the environment and respond appropriately in a negative (to slow down a process) or positive (to speed up a process) feedback loop manner.

Nature Inspired Innovations in Practice

There are lots of applications of the principles discussed above that point to the fact that drawing inspiration from nature is people-profit-planet (3P) friendly, and therefore can be used to ensure a safer planet earth.

Nature inspired innovations in architecture

Many buildings have been inspired by nature, the Eastgate building in Harare, Zimbabwe (Figure 1c) is a self-cooled high-rise building inspired by the anthill (Figures 1a & b) and uses 35 percent less energy than similar buildings in Zimbabwe (Canales, 2018). Many other buildings exist, that have been inspired by nature (Douglass, 2015; Bethune, 2017; Kaner, 2018)

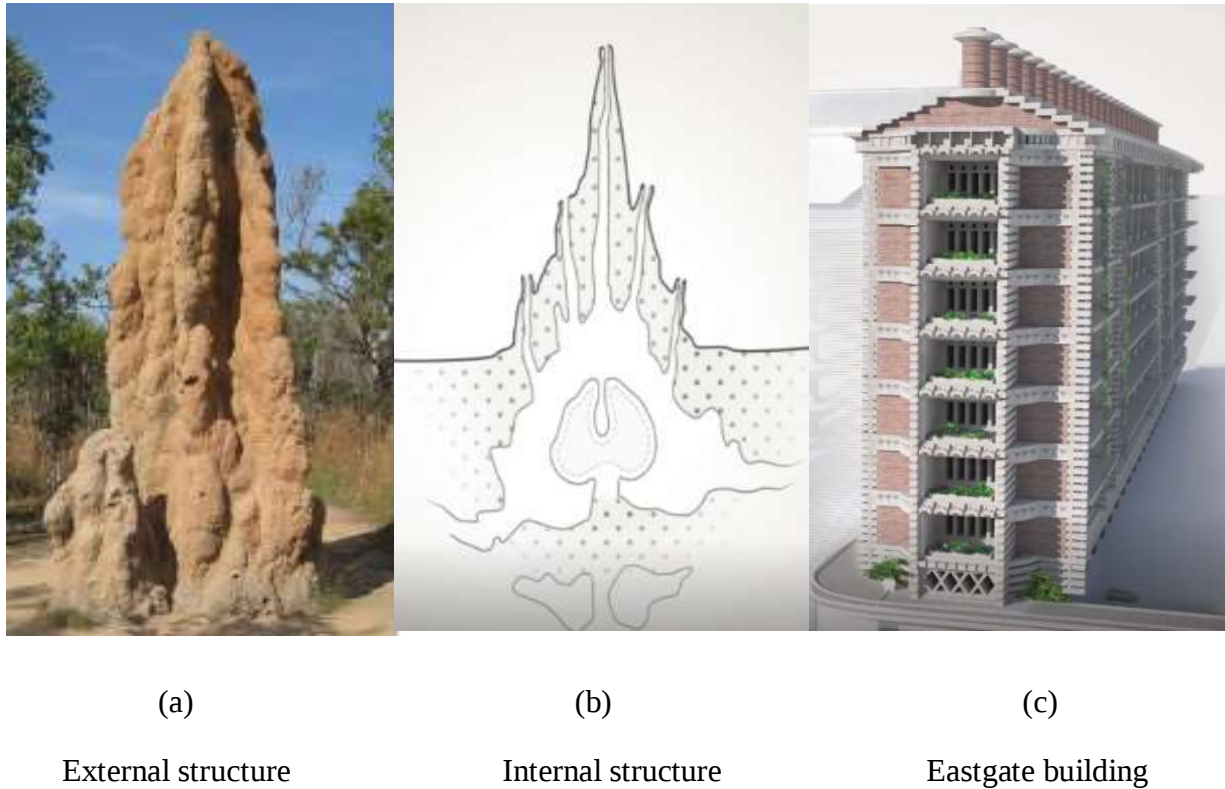


Figure 1. (a & b) From anthill to the (c) Eastgate building
(adapted from Fehrenbachery, 2012 and Canales, 2018)

Nature inspired innovations in medicine

Rattan, a plant similar to bamboo, has been found to have similar load bearing capacity and internal 3D structure to human bone, and is been proposed as a scaffold for bone regeneration (Mitha, 2019). Inspired by the jellyfish's ability to expand its tentacles to grab food (Zhao et al., 2012) came up with microchips that attach to cancer cells and can be used to observe them as they drift in the blood stream. Geckel, the waterproof glue has been used by surgeons to seal holes in organs and other tissue in large animals (Niiler, 2013), and is being proposed on humans (Yu and Cheng, 2018). Bencherif et al. (2012) inspired by the cellular structure of seaweeds, designed an implantable scaffold that is injectable and sponge like and can be used to fill the empty spaces created by surgery when a tissue is removed. Nacre, the inner shell layer of molluscs, has inspired the design of implants, porous scaffolds for bone repair, and also coatings for scaffolds to activate desired biological behaviour (Perera and Coppens, 2019). Medicinal plants have also been discovered by watching animals self-medicate (Shurkin, 2014).

Nature inspired innovations in communication

The way ants and bees forage and communicate with one another has been used in communication systems, British Telecoms, BT, took inspiration from the behaviour of ants when

it redesigned its phone network. Rodriguez (2012) has catalogued the different ways nature has inspired communication systems.

Nature inspired innovations in materials

Nature has a vast diversity of materials that have helped various organisms adapt in their natural environment. Researchers are being inspired by these natural occurring materials, studying them for their form and function, and then using them as models for artificially created ones with similar or completely new functions.

The spiny flexible skin of the porcupine fish inspired the manufacture of a durable and flexible superhydrophobic material (Yamauchi et al., 2019); The multilayered brick-and-mortar structure of the abalone seashell and that of the reindeer antlers have been mimicked to make metals that are tough, lightweight, and thin without being brittle (Zhang et al., 2019). A lightweight plastic that is stiff, strong (14 times stronger than metal), tough and can absorb the impact of bullets and projectiles has been invented by mimicking the outer coating of pearls (Zhang and Ren, 2019). Chameleons have also inspired flexible smart skin that changes color in response to heat and sunlight (Dong et al., 2019).

The spider web silk, which is known to be five times stronger than steel and tougher than Kevlar, the toughest man-made polymer used to make bulletproof vests (Vepari and Kaplan, 2007) has inspired the artificial spider silk. Kevlar is made under high pressure using concentrated sulphuric acid, while spiders produce silk using water as a solvent in the open air, at ambient temperatures and pressure (Viney, 1997). The artificial spider silk is also made at room temperature from common, easily accessible materials, – mainly water, silica and cellulose, it can be stretched several times its length before breaking, and is also completely biodegradable (Wu et al., 2017). Potential uses of the artificial spider silk are: bullet-proof clothing; wear-resistant lightweight clothing; ropes, nets, seat belts, parachutes; rust-free panels on motor vehicles or boats; biodegradable bottles; bandages, surgical thread and artificial tendons or ligaments, supports for weak blood vessels and much more (Babu, 2019).

In order to make poor quality wood stronger, Leary (1993) studied teak wood and petrified wood, known for their strength, durability and resistance to wood eating insects, and found that the walls of their cells contain silica and other minerals, which must have been absorbed from the soil through the roots. This was mimicked to make poor quality wood stronger by injecting it with a mixture of silica and alcohol in a pressurized container, thus forcing silica into the cells of the wood. The reinforced wood was found to be 120 percent stronger than the original.

Styrofoam, a polystyrene, is a petrochemical product which has found use in our everyday life for food and hot drink packaging; light packaging; home and appliance insulation, and also used as parts in the making of furniture, vehicles etc. However, styrofoam is very brittle, not biodegradable, not reusable or recyclable and is normally disposed of by incineration with the attendant air pollution problems. Due to its lightweight, it is easily blown by the wind and becomes a source of land and sea/ocean pollution. Mycofoam, an exact look-alike to Styrofoam, but unlike Styrofoam is completely biodegraded in weeks, and made from moisturised

agricultural waste inoculated with mushroom spores, is replacing styrofoam (Schiffman, 2013). Ikea, the Swedish-based international furniture and home accessories company is switching to mycofoam packaging for its furniture and home décor (Diskin, 2019), and it is also being considered for use in the construction industry for acoustic absorption panels (Pelletier et al., 2019).

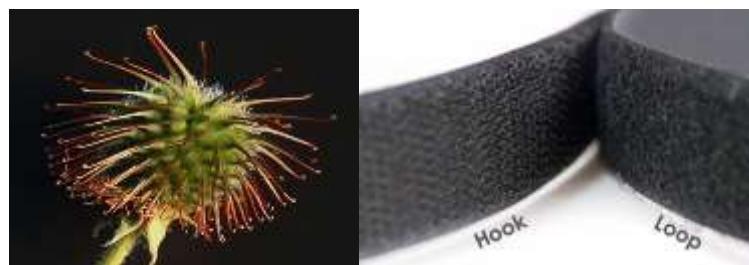
Shark's skin made up of countless overlapping scales has inspired swimsuits (sharkskin) for faster mobility in water (Oeffner and Lauder, 2012) and also to design the bottom of boats. It is currently being considered for faster swimming robots and airplanes. The rough shape also discourages parasitic growth, and this has inspired the design of a material, sharklet, for use in hospitals to cover surfaces and door handles to slowdown the growth and spread of bacteria (Dundar Arisoy et al., 2018).

Chakrabarti et al. (2019) and Kiat-Chan et al. (2019) have studied how the shape and texture of the Namibian desert beetle helps it capture water from the air (fog harvesting) in the extremely arid desert of Namibia; this can be exploited in designing beetle-inspired devices for harvesting desert fog and thus producing fresh water in desert regions.

Inspired by the way corals use the CO₂ dissolved in seawater to produce a secretion, calcium carbonate, that forms the skeleton for their body, Calera has avoided the release of half a ton of CO₂ for every ton of cement produced by the traditional cement industry (Schons, 2011).

Nature inspired innovations in product designs

Products are part of our everyday life, some of which have been inspired by nature. **Velcro**, an adhesive (figure 2) was inspired by plants with burs sticking to clothing and dog's fur. **Geckel** was inspired by the gecko's reversible sticking ability in any position, and the mussel (snail)'s slimy secretion, which is sticky and effective even when wet (Cho et al., 2019). The **Flexshapegripper**, a water filled elastic silicone cap that can pick and place any shape, size and quantity of objects, was modelled after the hunting strategy of a chameleon. The **Fin ray**



(a)

(b)

Figure 2. (a) Plant with burs as source for inspiration for (b), the Velcro tape

(a) https://upload.wikimedia.org/wikipedia/commons/thumb/1/13/Bur_Macro_BlackBg.jpg/993px-Bur_Macro_BlackBg.jpg

(b) <https://pmrpressrelease.com/wp-content/uploads/2019/06/Velcro-Hook-Loop-PMR.jpg>

effect gripper (Crooks et al., 2016) a flexible structure that automatically wraps around its object, was inspired by the fish fin's that bends in the opposite direction of an applied force. Pal et al. (2020) have also invented soft robotic grippers by inspiration from animals such as kangaroos, birds, salamander and toads that have the ability to store elastic energy for later use. **Gyroscope**, a navigational device for aircraft and submarines that does not rely on satellite, has been miniaturized based on inspiration from a fly's halteres - a vibrating wing-like organ the insect uses for navigation when it flies (Droogendijk et al., 2014; Kilic et al., 2016). The **aerial-aquatic robot** was inspired by the hydrofoiling mechanism bees use to move in water (Roh and Gharib, 2019). **Japan's 700-Series Shinkansen (the Bullet train)**, a fast moving train solved the 'sonic boom' problem at the exit of a tunnel by inspiration from a bird with a bullet like beak that dives swiftly and noiselessly into the water for its prey, the kingfisher (Barba, 2011). The redesigned bullet trains (Figure 3) were 10% faster, 30% more energy efficient, and under the 70-decibel noise limit (SCRAPLABS, 2018).



Figure 3. The kingfisher inspires the design of Japan's bullet train

Mercedes-Benz's bionic car (Figure 4) was inspired by the boxfish. The 4.24 m long, 4-occupant plus luggage car, had a high efficiency with 20% lower fuel consumption and 80% lower NOx emissions (when compared to cars of the same category) (Sharfman, 2006).



Figure 4. Mercedes-Benz's bionic car, inspired by the box fish (insert) (Sharfman, 2006)

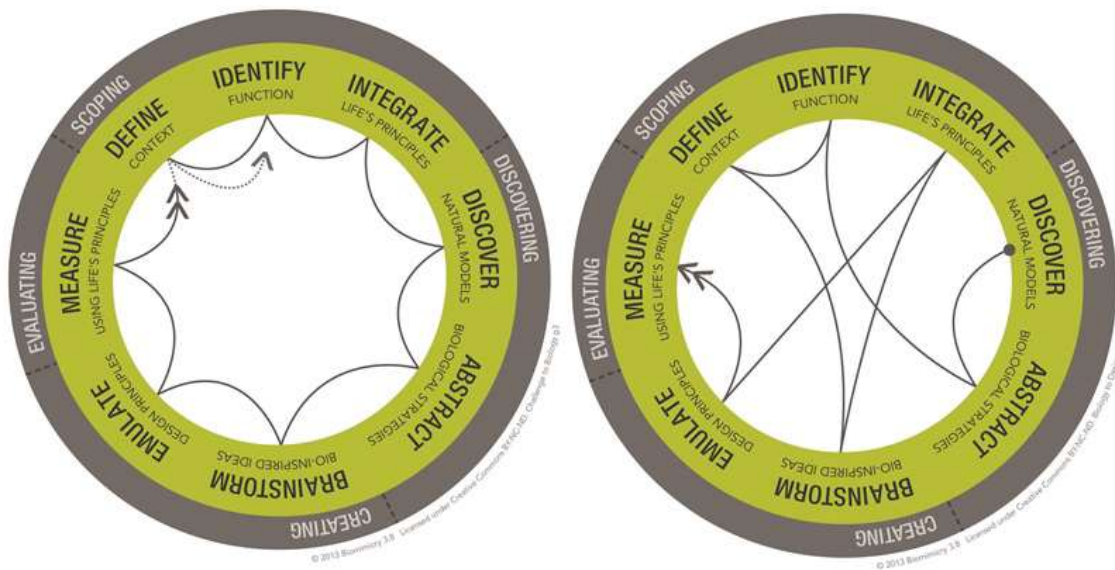
APPROACHES FOR IMPLEMENTATION

There are two approaches to the transfer of technology from nature: the design-to-biology, or problem-based approach, looks to nature as a model to solve a problem, as was the case for the

Mercedes Benz bionic car, where designers looked for an organism, that combined a specific form with desired aerodynamics, and found inspiration in the box fish (Figure 4). The biology-to-design, or solution-based approach sees in nature a form, function or system that is desirable and worthy of emulation and translates such into products/processes, as was the case in the plant with burs inspiring the Velcro tape, and gecko feet inspiring gecko tape.

There are basically four major phases, each with its own specific steps, in implementing any of the approaches above: **Scoping** involves defining the problem, and **then** translating it to biological terms, so that biological databases and literature can be easily accessed. Then there is the searching in biological databases, literature and brainstorming with biologists and naturalists to **discover** strategies nature uses to solve such problems. **Abstraction**, a reverse engineering process, expresses the discovered strategies in technical terms. **Creating** is another major phase where there is a lot of **Brainstorming** among team members so as to come up with concepts/solutions that **Emulate** the discovered and abstracted strategies. The created solutions are now **evaluated** against nature's principles. The design process is an iterative one because as new findings emerge, previous conclusions might need to be revised until a viable design solution is obtained.

Depending on the design approach, design-to-biology or biology-to-design, the pathway to be followed is as shown in figures 5(a) and (b) respectively. The design-to-biology approach starts with defining the problem, while the biology-to-design approach starts with discovering a model in nature.



(a) Design-to-biology approach

(b) Biology-to-design approach

Figure 5. Pathway to implementation (Biomimicry 3.8, 2015)

CONCLUSION – The way forward to saving our distressed planet earth

In order to make planet earth a comfortable place for man to live, engineers have exploited nature to provide services and products for man, most times, working against nature's own principles that have guided her survival for 3.8 billion years. Now our planet earth is distressed and there is an urgent need to save the earth and make it a safer place for man to live.

There is an urgent need for the engineering profession to come up with innovations that are not opposed to the way nature works, thus not being inimical to the earth. Emulating nature's survival strategies seems to be the only remedy for saving planet earth, nature-inspired innovations, aka biomimicry, is a field that has emerged to do just that. In the design of services and products for the benefit of man, the engineer must look to nature for design strategies, and since engineering uses the knowledge of scientific principles there is a need for the scientist, especially the biologist, to study nature and have a databank of nature's time-tested patterns and strategies for the engineer to draw inspiration from.

Since there must be a paradigm shift in the way innovations are done, it is necessary for engineering students to be taught biomimicry-in-engineering design, so that their products and services will not be inimical to the earth.

The time is now that solutions for man's challenges and technological advancement must be inspired from the natural world. Man is part of nature and not isolated from it, whatever befalls the earth also befalls man, now is time to move from the industrial revolution to the biomimicry revolution. Einstein said, "we cannot solve the problems we face in the same mindset that created them in the first place" Doing things the same way, and expecting a different result he said is insanity.

Nature inspired innovation, is indeed the only option we have left to save planet earth.

REFERENCES

- Aziz, M.S. and El Sherif, A.Y. (2016). Biomimicry as an approach for bio-inspired structure with the aid of computation. *Alexandria Engineering Journal*. <https://doi.org/10.1016/j.aej.2015.10.015>
- Babu, K.M. (2019). Spider silks and their applications. In *Silk: Processing, Properties and Applications The Textile Institute Book Series* (2nd ed., pp. 235–253). <https://doi.org/10.1016/b978-0-08-102540-6.00010-3>
- Barba, L.A. (2011). Bio-aerial Locomotion 2011 Shinkansen "bullet trains": Biomimicry at it's best. Retrieved March 28, 2020, from <https://blogs.bu.edu/biolocomotion/2011/10/03/shinkansen-“bullet-trains”-biomimicry-at-its-best/>
- Bencherif, S.A., Sands, R.W., Bhatta, D., Arany, P., Verbeke, C.S., Edwards, D.A. and Mooney, D. J. (2012). Injectable preformed scaffolds with shape-memory properties. *Proceedings of the National Academy of Sciences of the United States of America*, 109(48), 19590–19595. <https://doi.org/10.1073/pnas.1211516109>
- Benyus, J.M. (2002). *Biomimicry: Innovation inspired by nature*. HarperCollins e-books.

- Bethune, M. (2017). 9 Architectural Wonders Inspired by Nature. Retrieved March 28, 2020, from <https://www.nationalgeographic.com/travel/lists/biomimetic-buildings-inspired-by-nature/>
- Biomimicry 3.8. (2015). Biomimicry DesignLens, 1–17. Retrieved from <http://biomimicry.net/about/biomimicry/biomimicry-designlens/>
- Canales, M. (2018). Inspired by termites: How the Eastgate keeps cool. *National Geographic Magazine*, 233(No. 5), 28–29.
- Chakrabarti, U., Paoli, R., Chatterjee, S. and Megaridis, C.M. (2019). Importance of body stance in fog droplet collection by the namib desert beetle. *Biomimetics*, 4(3), 1–15. <https://doi.org/10.3390/biomimetics4030059>
- Cho, H., Wu, G., Jolly, J.C., Fortoul, N., He, Z., Gao, Y., ... Yang, S. (2019). Intrinsically reversible superglues via shape adaptation inspired by snail epiphragm. *Proceedings of the National Academy of Sciences of the United States of America*, 116(28), 13774–13779. <https://doi.org/10.1073/pnas.1818534116>
- Crooks, W., Vukasin, G., O’Sullivan, M., Messner, W. and Rogers, C. (2016). Fin Ray® effect inspired soft robotic gripper: From the robosoft grand challenge toward optimization. *Frontiers Robotics AI*, 3(NOV), 1–9. <https://doi.org/10.3389/frobt.2016.00070>
- Cyranoski, D. (2020). Did pangolins spread the China coronavirus to people? <https://doi.org/10.1038/d41586-020-00364-2>
- De Falco, P., Barbieri, E., Pugno, N. and Gupta, H.S. (2017). Staggered Fibrils and Damageable Interfaces Lead Concurrently and Independently to Hysteretic Energy Absorption and Inhomogeneous Strain Fields in Cyclically Loaded Antler Bone. *ACS Biomaterials Science and Engineering*, 3(11), 2779–2787. <https://doi.org/10.1021/acsbiomaterials.6b00637>
- Diskin, E. (2019). Ikea to use ‘mushroom packaging’ that will decompose in weeks. Retrieved April 9, 2020, from <https://matadornetwork.com/read/ikea-mushroom-packaging-decompose-weeks/>
- Dong, Y., Bazrafshan, A., Pokutta, A., Sulejmani, F., Sun, W., Combs, J.D., ... Salaita, K. (2019). Chameleon-Inspired Strain-Accommodating Smart Skin. *ACS Nano*, 13(9), 9918–9926. <https://doi.org/10.1021/acsnano.9b04231>
- Douglass, M. (2015). Nine incredible buildings inspired by nature. Retrieved March 28, 2020, from <http://www.bbc.com/earth/story/20150913-nine-incredible-buildings-inspired-by-nature>
- Droogendijk, H., Brookhuis, R.A., De Boer, M.J., Sanders, R.G.P. and Krijnen, G.J.M. (2014). Towards a biomimetic gyroscope inspired by the fly’s haltere using microelectromechanical systems technology. *Journal of the Royal Society Interface*, 11(99). <https://doi.org/10.1098/rsif.2014.0573>
- Dundar Arisoy, F., Kolewe, K.W., Homyak, B., Kurtz, I.S., Schiffman, J.D. and Watkins, J.J. (2018). Bioinspired Photocatalytic Shark-Skin Surfaces with Antibacterial and Antifouling Activity via Nanoimprint Lithography. *ACS Applied Materials and Interfaces*, 10(23), 20055–20063. <https://doi.org/10.1021/acsami.8b05066>
- Emmott, S. (2013). Humans: the real threat to life on Earth. Retrieved April 15, 2020, from

- <https://www.theguardian.com/environment/2013/jun/30/stephen-emmott-ten-billion>
- Fehrenbachery, J. (2012). BIOMIMETIC ARCHITECTURE: Green Building in Zimbabwe Modeled After Termite Mounds. Retrieved January 9, 2020, from <https://inhabitat.com/building-modelled-on-termites-eastgate-centre-in-zimbabwe/eastgate-centre-biomimetic-architecture-biomimicry-biomimetic-design-biomimicry-of-termite-mounds-green-building-with-termites-eco-building-sustainable-design-harare-zimbabwe>
- Kaner, E. (2018). *Wild buildings and Bridges:Architecture Inspired by Nature*. Kids Can Press Ltd.
- Kiat-Chan, F., Shahrokhian, A., King, H. and Gazzola, M. (2019). Surface morphology and flow dynamics for fog harvesting. In *72nd Annual Meeting of the APS Division of Fluid Dynamics*. Bulletin of the American Physical Society.
- Kilic, O., Ra, H., Akkaya, O.C., Digonnet, M.J.F. and Solgaard, O. (2016). Haltere-Like Optoelectromechanical Gyroscope. *IEEE Sensors Journal*, 16(11), 4274–4280. <https://doi.org/10.1109/JSEN.2016.2539687>
- Leary, W.E. (1993). Science Takes a Lesson From Nature, Imitating Abalone and Spider Silk. Retrieved April 2, 2020, from <https://www.nytimes.com/1993/08/31/science/science-takes-a-lesson-from-nature-imitating-abalone-and-spider-silk.html>
- Lee, H., Lee, B.P. and Messersmith, P.B. (2007). A reversible wet/dry adhesive inspired by mussels and geckos. *Nature*, 448(7151), 338–341. <https://doi.org/10.1038/nature05968>
- Marshall, A. and Lozeva, S. (2009). Questioning the theory and practice of biomimicry. *International Journal of Design and Nature and Ecodynamics*. <https://doi.org/10.2495/DNE-V4-N1-1-10>
- Mitha, F. (2019). Biomimicry in Biotech: Taking Inspiration from Nature. Retrieved April 21, 2020, from <https://www.labitech.eu/features/biomimicry-biotech-nature-inspiration/>
- Niiler, E. (2013). New medical technology draws on nature for inspiration. Retrieved April 21, 2020, from https://www.washingtonpost.com/lifestyle/style/new-medical-technology-draws-on-nature-for-inspiration/2013/03/18/6b3b811a-4ae4-11e2-9a42-d1ce6d0ed278_story.html
- Nørgaard, T. and Dacke, M. (2010). Fog-basking behaviour and water collection efficiency in Namib Desert Darkling beetles. *Frontiers in Zoology*, 7, 1–8. <https://doi.org/10.1186/1742-9994-7-23>
- Oeffner, J. and Lauder, G.V. (2012). The hydrodynamic function of shark skin and two biomimetic applications. *Journal of Experimental Biology*, 215(5), 785–795. <https://doi.org/10.1242/jeb.063040>
- Pal, A., Goswami, D. and Martinez, R.V. (2020). Elastic Energy Storage Enables Rapid and Programmable Actuation in Soft Machines. *Advanced Functional Materials*, 30(1), 1–9. <https://doi.org/10.1002/adfm.201906603>
- Pelletier, M.G., Holt, G.A., Wanjura, J.D., Greetham, L., McIntyre, G., Bayer, E. and Kaplan-Bie, J. (2019). Acoustic evaluation of mycological biopolymer, an all-natural closed cell foam alternative. *Industrial Crops and Products*, 139(July), 111533. <https://doi.org/10.1016/j.indcrop.2019.111533>

- Perera, A.S. and Coppens, M.O. (2019). Re-designing materials for biomedical applications: From biomimicry to nature-inspired chemical engineering. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 377(2138). <https://doi.org/10.1098/rsta.2018.0268>
- Rodriguez, A.M. (2012). *Biomimicry Specialist Program 2012*. Retrieved from <https://pdfs.semanticscholar.org/30db/31b748a18774e87b18f8ab8000af30714956.pdf>
- Roh, C. and Gharib, M. (2019). Honeybees use their wings for water surface locomotion. *Proceedings of the National Academy of Sciences of the United States of America*, 116(49), 24446–24451. <https://doi.org/10.1073/pnas.1908857116>
- Schiffman, R. (2013). Mushrooms are the new styrofoam. Retrieved April 9, 2020, from <https://www.newscientist.com/article/mg21829210-300-mushrooms-are-the-new-styrofoam/>
- Schons, M. (2011). Working with Nature to Slow Global Warming What do coral reefs and cement have in common? How can they slow global warming? Retrieved April 21, 2020, from <http://admin.nationalgeographic.org/article/working-with-nature-to-slow-global-warming/>
- SCRAPLABS. (2018). How The Bullet Trains Found Their Efficient Design. Retrieved April 1, 2020, from <http://blog.scraplabs.in/scruplabs-stories/biomimicry>
- Sharfman, B. (2006). Mercedes and the boxfish. *TheScientist*. Retrieved from <https://www.the-scientist.com/notebook-old/mercedes-and-the-boxfish-47247>
- Shurkin, J. (2014). News feature: Animals that self-medicate. *Proceedings of the National Academy of Sciences of the United States of America*, 111(49), 17339–17341. <https://doi.org/10.1073/pnas.1419966111>
- Vepari, C. and Kaplan, D.L. (2007). Silk as a biomaterial. *Progress in Polymer Science (Oxford)*, 32(8–9), 991–1007. <https://doi.org/10.1016/j.progpolymsci.2007.05.013>
- Viney, C. (1997). Natural silks: archetypal supramolecular assembly of polymer fibres. *Supramolecular Science*, 4(1–2), 75–81. [https://doi.org/10.1016/S0968-5677\(96\)00059-4](https://doi.org/10.1016/S0968-5677(96)00059-4)
- Wu, Y., Shah, D.U., Liu, C., Yu, Z., Liu, J., Ren, X., ... Scherman, O. A. (2017). Bioinspired supramolecular fibers drawn from a multiphase self-assembled hydrogel. *Proceedings of the National Academy of Sciences of the United States of America*, 114(31), 8163–8168. <https://doi.org/10.1073/pnas.1705380114>
- Yamauchi, Y., Tenjimbayashi, M., Samitsu, S. and Naito, M. (2019). Durable and Flexible Superhydrophobic Materials: Abrasion/Scratching/Slicing/Droplet Impacting/Bending/Twisting-Tolerant Composite with Porcupinefish-Like Structure. *ACS Applied Materials and Interfaces*, 11(35), 32381–32389. <https://doi.org/10.1021/acsami.9b09524>
- Zhang, Y., Heim, F.M., Bartlett, J.L., Song, N., Isheim, D. and Li, X. (2019). Bioinspired, graphene-enabled Ni composites with high strength and toughness. *Science Advances*, 5(5), 1–10. <https://doi.org/10.1126/sciadv.aav5577>
- Zhang, Z. and Ren, S. (2019). Functional Gradient Ultrahigh Molecular Weight Polyethylene for Impact-Resistant Armor. *ACS Applied Polymer Materials*, 1(8), 2197–2203.

<https://doi.org/10.1021/acsapm.9b00456>

Zhao, W., Cui, C.H., Bose, S., Guo, D., Shen, C., Wong, W.P., ... Karp, J.M. (2012). Bioinspired multivalent DNA network for capture and release of cells. *Proceedings of the National Academy of Sciences of the United States of America*, 109(48), 19626–19631. <https://doi.org/10.1073/pnas.1211234109>

PREDICTIVE MODELLING OF COVID-19 PANDEMIC

***Emmanuel Agunloye and Mohammed A. Usman**

Department of Chemical and Petroleum Engineering

University of Lagos, Akoka

Lagos, Nigeria

*eagunloye@unilag.edu.ng

ABSTRACT

COVID-19, a disease caused by coronavirus, is a global pandemic currently ravaging the world. From tens of cases reported in January 2020, the disease as of August 2020 has infected over 16 million people worldwide, thus becoming a concern to everyone. Modelling can be used to describe the pandemic and assess the effectiveness of various control measures. This paper presents results from a model developed to predict the time evolution of total confirmed cases of COVID-19. The model, which is an exponential equation, is derived from the balance equation modelling, where the time evolution of cases is the accumulation term. While COVID-19 carriers' cross-border migration can affect the cases within a society, the developed model considers a closed border scenario and mimics a batch system. Therefore, confirmed cases can only be affected by transmission within a society as well as death or recovery rate of infected cases. While death or recovery occurs days after, a carrier can begin transmission as soon as coming in contact with the disease. China, the country where the disease was first reported, did not record any death or recovery from COVID-19 until mid-January 2020 (Ravelo and Jerving, 2020). Neglecting death and recovery terms, the model resulted in an exponential equation. Some of the COVID-19 data reported in China from 01 – 11 January 2020 were used to obtain the exponential rate constant as 0.1706 day^{-1} at an r-squared value of 0.9963. In fourteen days, the reported period for the disease to manifest, the value of this pseudo-rate constant is 2.39. This value is comparable to the transmission rate of 2.2 reported by Sun et al. (2020). The remaining data from 01 – 11 January 2020 were used to validate the model. Model predictions yielded good agreement with reported data.

Keywords: covid-19, coronavirus, balance equation modelling, transmission rate

Introduction

COVID-19, a disease caused by the novel coronavirus, is a global pandemic ravaging the world. From the mild symptoms of flu, cough and catarrh, it aggravates into acute respiratory problems in about 14 days, and may eventually lead to death (Velavan and Meyer, 2020; Sun et al., 2020). As at June 9, 2020, all over the world, about 7.12 million confirmed cases of people have tested positive of the disease, which has claimed more than 400,000 lives (CSSE, 2020). First detected

towards the end of 2019 in the City of Wuhan, China, it migrated to other countries with Thailand, Japan, Australia, and USA recording their index cases in January 2020. In about 120 days, the disease had spread to 209 countries in six continents (Ravello and Jerving, 2020).

While the disease is thought to have originated by bat to human mechanism, called zoonosis, its spread from the pocket of cases reported in December 2019 to millions of cases worldwide occurred by contacting droplets from carriers transiting places, cities, countries and continents (Sun et al., 2020; CDC, 2020; Bourouiba, 2020). In containing the spread, while research to discover a vaccine is ongoing, measures recommended by the World Health Organisation can be categorised into two; 1) stopping the spread from carriers, and 2) disinfecting external surfaces (WHO^a, 2020). Stopping the spread involves using face masks, social distancing and total lockdown as well as self-isolating, quarantining and managing the disease in care units (Guan et al., 2020; WHO^b, 2020). Many countries around the world are under lockdown to limit interaction and spread of the disease (Sandford, 2020; UNESCO, 2020). Since China implemented this measure in Wuhan in particular, cases of COVID-19 have been reduced significantly (Liu et al., 2020). Total lockdown, however, is catastrophic to the economy, as there is no production of goods and services, for example water, and food that are essential to sustain life (Gopinath, 2020). In fact, this alternative is equally able, if not more, to cause the extinction of humanity. Therefore, proposing another option of survival is sacrosanct.

Various authors have made contributions towards understanding the spread of COVID-19. Sun et al. (2020) provided evidence on the characteristics of the disease as a basis for further understanding while Li et al. (2020) reported the disease patients' statistics and showed that the disease transmission rate was 2.2 per patient. In their contribution, Wang et al. (2020) updated information about the disease providing further demographic knowledge. Lu (2020) on his part, discussed treatment options for the disease.

As a viable option, modelling can be used to describe the spread and determine the impacts of various measures to it. With modelling, further investigations can be undertaken that would help in developing a policy for the survival of a society. Infected people within a society evolve over time under the influence of processes such as contagious transmission of the disease, migration of carriers across boundary, and recovery or death caused by the disease. In epidemiology, the different populations (that is infected, susceptible and dead) influenced by these processes are considered as separate compartments. The modelling applied therefore is called compartment modelling (Kermack and McKendrick, 1927; Harko et al., 2014). This modelling approach is a variant of the balanced equations modelling employed in chemical reactions and particulate processes, where each component accumulates over time under the influence of convection, generation and disappearance (Ranade, 2002). Derivation of the balanced equations modelling from first principle and then accounting for the peculiarities of the epidemiology of coronavirus would yield modelling specific to the spread of COVID-19. Thus, balanced equations modelling for the disease is derived in this paper.

Chen and Yu (2020) recently reported their modelling work on COVID-19, where they employed discrete modelling enhanced by an exponential model with a closed-population assumption. Similarly, in this article, exponential modelling resulting from the balance equation

modelling is employed. Apart from the closed-population assumption, deriving the exponential modelling also involves assuming the period to be restricted to the early part of the pandemic trajectory, where almost no deaths and/or recoveries from the disease have been recorded. Thereafter, epidemiological data of COVID-19 cases reported in the early part of the pandemic for China and Nigeria are employed to validate the model.

COVID-19 evolution mechanism

In this section, we describe how the population of a society evolves with a focus on the effects of COVID-19 while accounting for the effects of other diseases using the population growth rate. By definition, the population growth rate accounts for births, deaths and migration (Bongaarts, 2009). COVID-19 affects a society and classifies the entire human population into four: infected, susceptible, recovered and dead populations. While the infected population are the people at various stages of infections: asymptomatic, mild, severe and acute COVID-19 carriers, the susceptible population are those potentially capable of contracting the disease. They are the remaining living human population including the recovered population, as it has been reported that people who have recovered from the disease can become re-infected (Laguipo, 2020). The dead population are the fatal victims of the disease.

The infected and susceptible populations can be influenced by processes such as migration across boundary, transmission by person-to-person contact, death or recovery within a society. On the other hand, the recovered and dead populations, as their names suggest, are affected by recovery or death of the infected population. Societies and the world at large aim to eliminate the processes that increase the infected population.

As a measure to prevent further importation of the disease, countries introduced border closures (land, sea and air), except in the case of essential services (Sandford, 2020; UNESCO, 2020). Therefore, migration across boundary and in particular of infected people become insignificant. Any country that has introduced this measure can be analysed as a closed system. Within a country, measures to minimise transmission by person-to-person contact within a society include use of sanitizers, face masks, handwashing with soap and water, social distancing, partial and total lockdowns. In minimising deaths from COVID-19, measures include immune boosting, supportive care such as the use of ventilators, and vaccination (Spear, 2020).

Due to the exponential increase in confirmed cases including infecting frontline medical personnel wearing personal protective equipment, many countries are under lockdown in an effort to enforce social distancing. In the latter, a safe distance of about 2 m has been recommended (Shukman, 2020). Under a no-lockdown situation, people flock to places such as public markets, schools, churches, mosques and event centres, mainly by public transport. In an extreme case, there would be no space between 2 persons. This picture would lead to having approximately 6 by 6 people occupying 2 by 2 m², that is, 9 persons per m². In city buses with standees, this number can be reduced to 6 while in buses without standees, it can be reduced to 3 (ITDP, 2006). By the recommended social distancing, however, the number should be a

maximum of 5 persons per 8 m^2 , i.e., $0.625 \text{ person per m}^2$. Figure 1 illustrates this situation of four people at the corners of a square with one person at the centre. The four people at the corners maintain from the one at the centre the 2 m recommended distance away. Using plain shape geometry theorems, the length of each side of the square yields $2\sqrt{2} \text{ m}$.

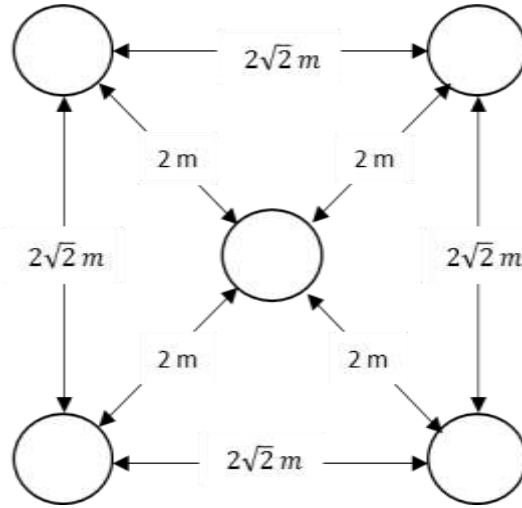


Figure 1: Arrangement of people to ensure social distancing as well as optimise space, the circles representing people.

The maximum social distancing possible in society under a lockdown can be estimated by dividing population by the available land area. For example, Nigeria with a population of about 201 million and an area of $924,000 \text{ km}^2$ could potentially have $0.000218 \text{ person per m}^2$ (Akinkuotu, 2018; Olajide and Akinlabi, 2011). When compared to the recommended social distancing population density, the latter value would help in slowing down the spread of the disease. Even in Manila in the Philippines, the city with the highest population density in the world with a value of $0.0462 \text{ persons per m}^2$, total lockdown would still stop the spread (PSA, 2006).

Apart from COVID-19, other factors such as natural births and deaths, accidents, other diseases and disasters also affect the population of a society. The combined effect of these factors is captured in the population growth rate. Bahrain has the highest population growth rate in the world with a value of 4.26% per annum, equivalent to 0.36% per month (UN, 2017). Because this value is insignificant, neglecting the influence of other factors on the population over a short time is reasonable.

Even the influence of confirmed cases on the susceptible population may be neglected. The global confirmed cases as at 11 June 2020 are about 7.41 million people, accounting for 0.095% of the world's population, which stands at about 7.8 billion people (CSSE, 2020; UNDP, 2019, Worldometers, 2020^a). From this percentage value, it is reasonable to assume that, from the discovery of COVID-19 in December 2019 to 11 June 2020, the world's population is constant. Still as at 11 June 2020, in the US, the worst-hit country, the confirmed cases are about 2.08 million people, accounting for 0.63% of its population of 331 million people (CSSE, 2020;

UNDP, 2019, Worldometers, 2020^b). In the US, the dead population of 62,257 people accounts for about 5.6% of the total confirmed cases. This same percentage is shared by the world with a total dead population of 421, 247 people.

With this background, a model for the evolution of the different populations can therefore be developed.

Modelling for the evolution of COVID-19

In this section, we begin with balance equation modelling and then simplify based on the assumptions stated in the previous section.

A balance equation is written as:

$$Acc = (In - Out) + Gen \quad (1)$$

where in our consideration, Acc is the accumulation rate of a population (i.e. the rate of change of people with time in the control area S). S is the area of the society on the spherical earth. $In - Out$ is the net migration of people entering S and Gen is the population generation rate (i.e. the number of people generated within the control area per unit time).

Before further derivation, the population density of i people in a place, defined as the population of i people in the place per unit area, is represented as $P_i(r, \theta, \varphi, t)$. As shown explicitly, P_i is a function of the spherical polar coordinates (r, θ, φ) and time (t) . We refer to Arfken and Weber (2007) for details about the spherical coordinates. By definition, the population of i people in a differential area dS is given as $P_i(r, \theta, \varphi, t)dS$ and in the total area S of a society is given as $\int_S P_i(r, \theta, \varphi, t)dS$.

By definition, the accumulation term in Eq. (1) is given as:

$$Acc = \frac{N_i(t+dt) - N_i(t)}{dt} = \frac{d}{dt} \left(\int_S P_i(r, \theta, \varphi, t)dA \right) = \int_S \frac{\partial P_i}{\partial t} dS \quad (2)$$

The last passage in the equation above holds because S is fixed; that is, it is not a time-dependent integration domain.

The $(In - Out)$ in Eq. (1) is contributed by the migration of i people across the border of the society. Migration can be by different transport ways: land, sea or air. In this modelling, we consider a society with closed borders. Thus:

$$(In - Out) = 0 \quad (3)$$

For the last term in Eq. (1), the generation term, we have:

$$Gen = \int_S r_i(r, \theta, \varphi, t) dS \quad (4)$$

where $r_i(r, \theta, \varphi, t)$ is the rate of generation of i people per unit area from various events and it is a function of both the area and time.

Substituting the equations into Eq. (1), we have:

$$\int_S \frac{\partial P_i}{\partial t} dA = \int_S r_i(r, \theta, \varphi, t) dS \quad (5)$$

Since this equation has to be satisfied for an arbitrary control volume, assuming that the integrand function is continuous, we conclude that it must be:

$$\frac{\partial P_i(x, y, t)}{\partial t} = r_i(r, \theta, \varphi, t) \quad (6)$$

This expression depends on the coordinate of the projected control area as well as time. We can make it time-dependent only by integrating over area as follows.

The left-hand side in eq. (6) is transformed as:

$$\int_S \frac{\partial P_i(r, \theta, \varphi, t)}{\partial t} dS = \frac{d}{dt} \int_S P_i(r, \theta, \varphi, t) dS = \frac{d}{dt} [\langle P_i(t) \rangle \cdot S] = S \frac{d\langle P_i(t) \rangle}{dt} \quad (7)$$

Similarly, the right-hand side is transformed as:

$$\int_A r_i(r, \theta, \varphi, t) dS = S \langle r_i(t) \rangle \quad (8)$$

Imposing that conditions within a society are the same (such as the average COVID-19 transmission, death and recovery rates), that is:

$$\langle P_i(t) \rangle = P_i(t) \text{ and } \langle r_i(t) \rangle = r_i(t) \quad (9)$$

Equation (6) becomes:

$$\frac{dP_i(t)}{dt} = r_i(t) \quad (10)$$

Expressions for r_i would depend on the mechanism of generating i people in the society. If the mechanism increases P_i , r_i carries a positive sign; otherwise, it carries a negative sign. We discuss expressions for r_i as follows.

Infected population

COVID-19 is transmitted by person-to-person contact; the transmission requires interactions between the infected and susceptible populations. While this transmission increases the infected population, it decreases the susceptible population. After the infection, in three to six weeks, a person with severe symptoms can recover from or die of the disease (WHO^c, 2020). Recovery or death depends on the biological immune system of the infected population; the immune system may be enhanced by treatment. The generation terms for the time evolution of the infected population therefore comprise transmission, death and recovery. Based on the foregoing, for the infected population, Eq. (10) can be written as:

$$\frac{dP_F}{dt} = r_F = k_F P_F P_S - (k_R + k_D) P_F \quad (11)$$

Where P_F and P_S (both measured in per m^2) are the population densities for the infected and susceptible populations; and k_F (measured in m^2 per day), k_R , k_D (both measured per day) are the disease infection, recovery and death rate constants.

Susceptible population

As expected, the transmission of COVID-19 decreases the susceptible population by the same amount it increases the infected population as shown in Eq. (11). Furthermore, the susceptible population changes by adding the recovered population, since this population can become re-infected with the disease. To account for other factors such as birth, death and accidents, the demographic population growth rate parameter of the society is used. The addition to the susceptible population due to this growth rate parameter is a proportion of the susceptible and infected populations. Based on the foregoing, the balanced equation for the susceptible population can be written as:

$$\frac{dP_S}{dt} = k_R P_F - k_F P_F P_S - k_G (P_F + P_S) \quad (12)$$

where k_G (measured in per day) is the demographic growth rate of the society.

In this equation, the recovered population has been added directly to the susceptible population as there is no time lag between recovery and susceptibility. However, we need to separately describe the evolution of the recovered and dead populations, to be able to determine the total number of people confirmed with the disease whether currently infected, recovered or dead.

The recovered and dead populations would evolve as follows:

Recovered population

$$\frac{dP_R}{dt} = k_R P_F \quad (13)$$

Dead population

$$\frac{dP_D}{dt} = k_D P_F \quad (14)$$

Equations (11) – (14) describe the time evolutions of the different populations within a closed society under the influence of COVID-19.

The equations can be simplified by imposing certain conditions. One condition is considering a short period of time after the index case is detected but before death or recovery occurs. This condition would affect the model as follows.

Infected population:

$$\frac{dP_F}{dt} = k_F P_F P_S - (k_R + k_D) P_F = k_F P_F P_S \quad (15)$$

Recovery and death are negligible.

Susceptible population

$$\frac{dP_S}{dt} = k_R P_F - k_F P_F P_S - k_G (P_F + P_S) = 0; P_S = B \text{ (a constant)} \quad (16)$$

The effects on the overall susceptible population of infection, recovery and other factors within a short time are negligible.

By substituting Equation (16) into equation (15), the latter can be integrated to yield:

$$\ln(P_F/P_{F0}) = k_F B t; P_F = P_{F0} e^{(A t)} \quad (17)$$

where $A = k_F B$; it is a pseudo-exponential rate constant. Its value indicates how fast the disease spreads. As $A \rightarrow 0$, $P_F \rightarrow P_{F0}$; thus, there is no spread of the disease. On the other hand, as long as A is positive, $P_F \rightarrow \infty$; the disease continues to spread.

Equation (17) is an exponential equation, a simplified form of the balanced equations model, and describes the initial transmission of the disease, which reported data show as increasing exponentially. Authors such as Chen and Yu (2020) have used an exponential equation to describe the transmission.

Recovery and death occurs after about a month. Within this period, having increased exponentially, the infected population would be much more than the combined population of recovery and death but insignificant when compared to the susceptible population. This scenario is supported by reported data of covid-19. Therefore, in modelling for this scenario, the infected population could still be unaffected by death and recovery just as the susceptible population remains constant. The recovery and death populations would begin to evolve. Mathematically, for the infected population, we write:

$$P_F = P_{F0} e^{(A t)} \quad (18)$$

For the susceptible population, we write:

$$P_S = B \text{ (a constant)} \quad (19)$$

For the dead population, we substitute Eq. (18) into Eq. (13) as:

$$\frac{dP_D}{dt} = k_D P_{F0} e^{(A t)} \quad (20)$$

Integrating eq. (20) yields:

$$P_D = \frac{k_D P_{F0}}{A} e^{(A t)} + C \quad (21)$$

Imposing the initial condition: @ $t = 0$, $P_D = 0$ yields:

$$C = -\frac{k_D P_{F0}}{A} \quad (22)$$

Therefore, Eq. (21) becomes:

$$P_D = \frac{k_D P_{F0}}{A} (e^{(At)} - 1) \quad (23)$$

Lastly, for the recovered population, its derivation is similar to that of the dead population. Thus, we have:

$$P_R = \frac{k_R P_{F0}}{A} (e^{(At)} - 1) \quad (24)$$

Eqs (18), (19), (23) and (24) describe the populations under the second scenario.

Furthermore, as stated in the previous section, social distancing and ultimately total lockdown, by decreasing the susceptible population density from 9 persons per m² obtainable in congested areas, would reduce the transmission rate of COVID-19. In Eq. (17), the pseudo-rate constant is a product of the specific rate constant and the susceptible population (=9 persons/m²). Thus:

$$A_C = k_F B_C; k_F = A_C/9 \quad (25)$$

Where A_C and B_C are the notations for a congested population.

Introducing social distancing of 2 m, the constant B is replaced B_S and its value would be 0.625 persons/m². For the expression for the pseudo-rate constant under social distancing A_S , we have:

$$A_S = k_F B_S = 0.07 A_C \quad (26)$$

From Eq. (26), the pseudo-rate constant has decreased by more than one order of magnitude, thus decreasing the disease transmission by a similar magnitude.

The value of A_S indicates the effectiveness of the measures employed in containing the disease. Under an absolute total lockdown situation in Nigeria, where the value of B_S is 0.000218 person per m² as shown in Section 2, Eq. (26) becomes:

$$A_S = k_F B_S = 2.42 \times 10^{-5} A_C \quad (27)$$

Thus, the disease spread under a total lockdown is negligible in comparison to the spread in a congested situation.

Results and discussion

Before employing the exponential model to calculate the infected population with time, the value of the pseudo-exponential rate constant A and that of the initial infected population P_{F0} must be specified. These parameters can be determined from data that satisfy the assumptions of the exponential model. The data reported in China in the period 01 – 11 January, 2020 satisfy the assumptions. These data are reliable as the country had begun taking records of the infected cases. In this period, the infected population was contained only within China; infected cases outside China were reported later than this period. Also, China did not report any death or

recovery from the disease until mid-January. Lastly, within this period, the susceptible population density of China can be assumed to be constant.

Some of the data from the period are used to obtain the value of the pseudo-exponential rate constant while the remaining data are used to validate the model. The number of cases on January 01, 2020 is taken as the initial infected population. Figure 2 shows the correlation for some of the data to obtain the value of the pseudo-exponential rate constant. At an r-squared value of 0.9963 for the correlated data, the value of A_C the pseudo-rate constant is 0.1706 per day. This number indicates the rate of infection per day. Rather than per day, per fourteen days can be used. Fourteen days is the average number of days for COVID-19 patient to show acute symptoms of the disease. Per fourteen days, the value of the constant is 2.39. The latter value compares with the transmission rate of 2.2 reported by Sun et al. (2020).

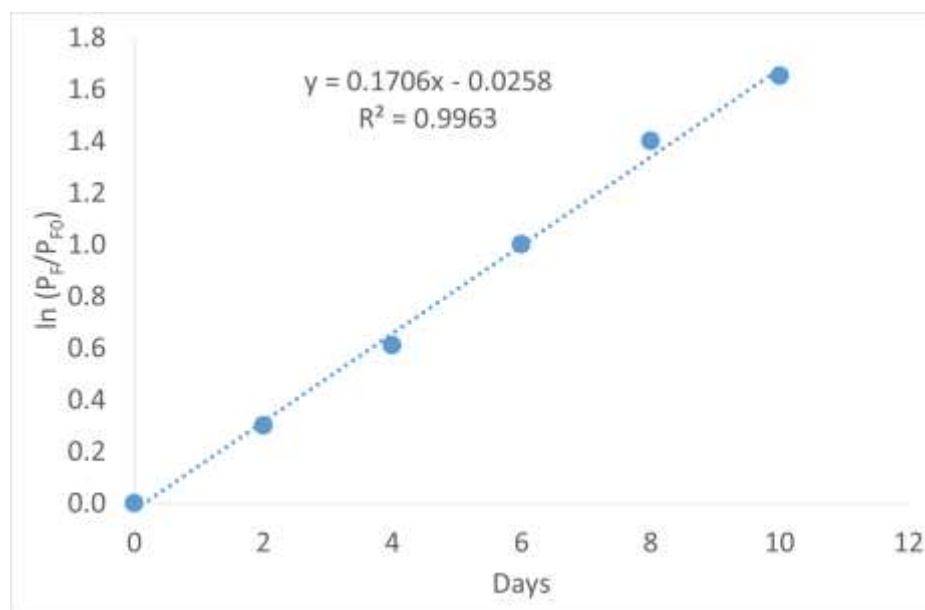


Figure 2: Correlation of data to obtain the rate constant of the exponential model. Data from Chen and Yu (2020)

The remaining data of COVID-19 cases reported in China in the period 01 – 11 January 2020 are used to validate the model. Figure 3 shows the validation.

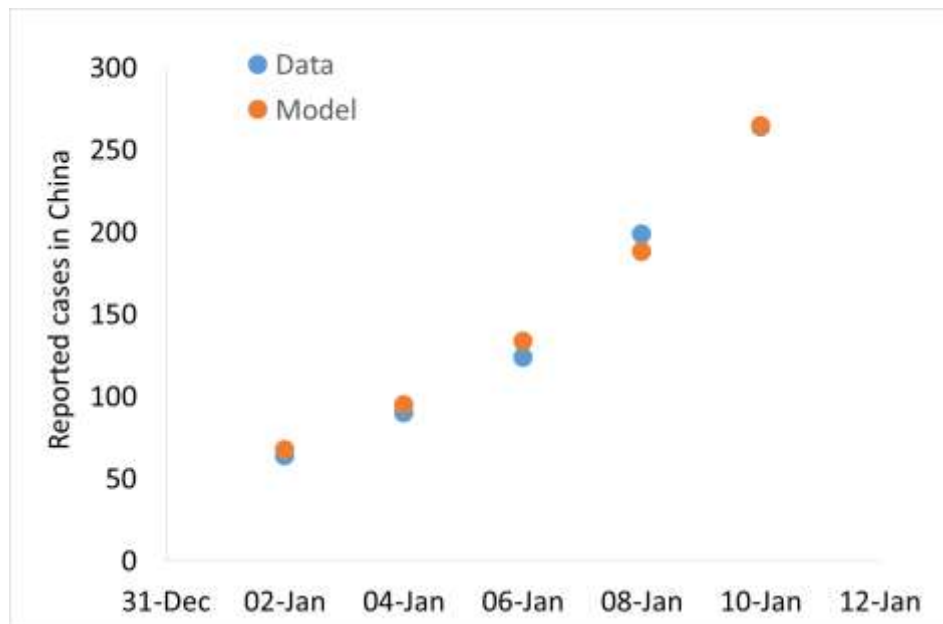


Figure 3: Model predictions of reported cases of covid-19 in China in the period 02 -10 January 2020. Data from Chen and Yu (2020)

As shown, the model gives excellent predictions of the reported cases of COVID-19 in China. Furthermore, we used the model to predict the cases in China for the whole of January 2020. This is shown in Figure 4. For this period, the model is also able to give good predictions of the COVID-19 cases in China. The deviation in the period 18 – 25 January may be due to migration of COVID-19 carriers from China to other countries. For example, countries like Japan, South Korea, Australia, France, Malaysia and USA reported their index cases within this period. Thereafter, influx of carriers back to China resulted in further transmission as reflected in the steep rise of cases as shown in Figure 4.

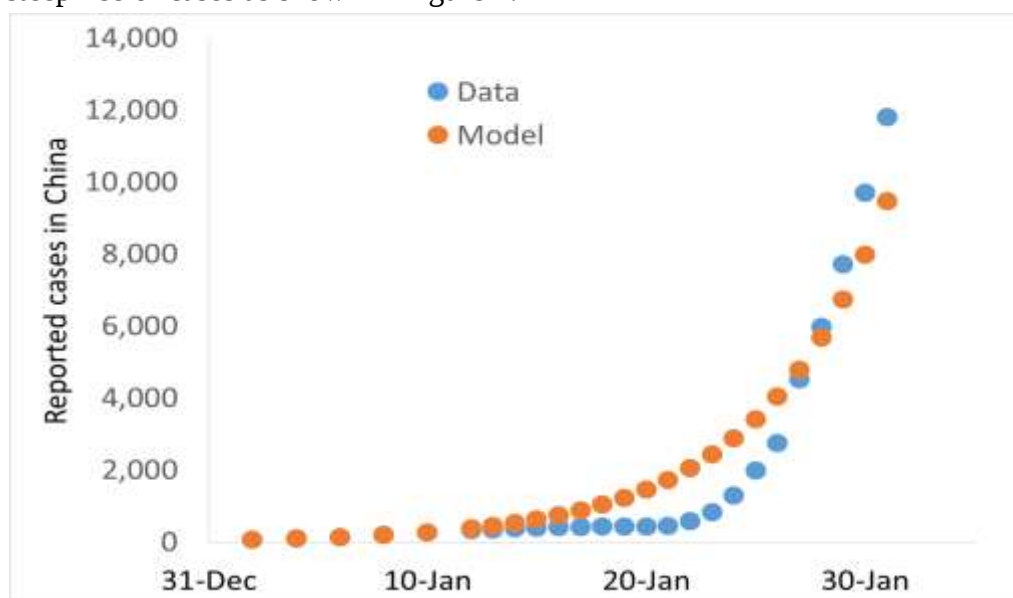


Figure 4: Model predictions of reported cases of covid-19 in China in the period of January 2020. Data from Chen and Yu (2020)

Considering the accuracy of these predictions, the model along with the rate constant value was used to predict the evolution of confirmed covid-19 cases in Nigeria after border closure but before the lockdown, spanning from March 22 to March 31, 2020. During this period, Nigeria can be considered as a closed society. Furthermore, only two death cases out of 151 confirmed cases of covid-19 were reported; the first death case was reported on March 23, 2020 while the second was on March 31 (Emorinken, 2020). Also, only five covid-19 patients had recovered. The second death was reported on March 31, 2020 (Oyeleke, 2020). When combined, deaths and recoveries represented less than 5% of the confirmed cases of 151.

Figure 5 shows the predictions. For the Nigerian situation, the model is still able to give good predictions.

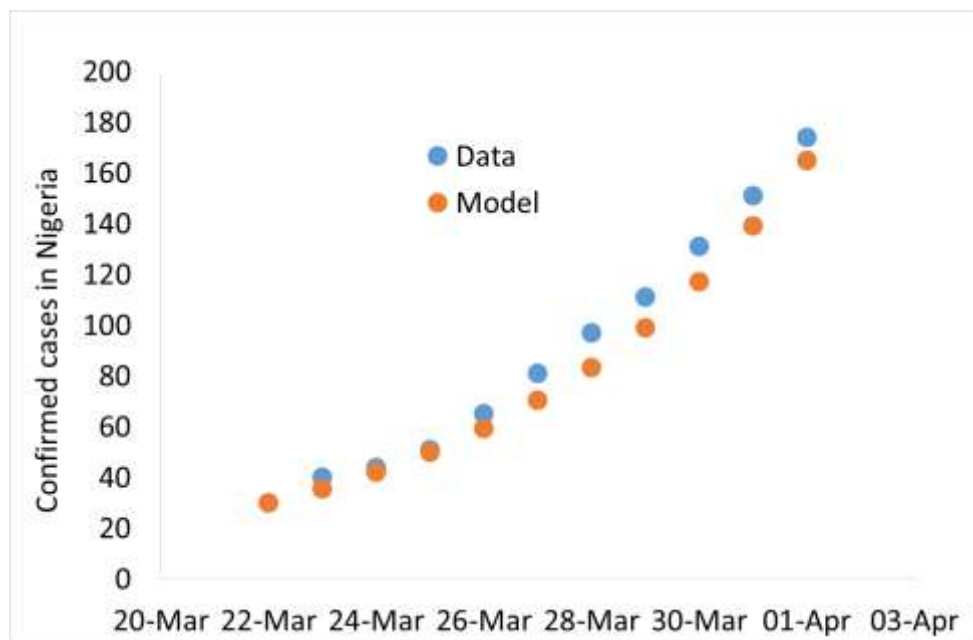


Figure 5: Model predictions of reported cases of covid-19 in Nigeria after border closure but before the lockdown. Data from NCDC (2020).

However, under lockdown as shown in Figure 6, the model predictions diverge from the confirmed cases of covid-19 in Nigeria. The data begin to flatten out. This flattening process may be due to restriction of movements during the lockdown, which curtail the spread of the disease.



Figure 6: Model predictions of reported cases of covid-19 in Nigeria showing the effect of lockdown. Data from NCDC (2020).

It is clear that the value of A_C ($=0.1706$ per day) is too high for the society because of the lockdown. As announced by the Federal Government of Nigeria, this lockdown took effect on March 31, 2020 in Lagos, Ogun and the FCT (the states with first and most cases as at date). Other State Governments also implemented in their states the same lockdown before or as soon as their index cases were reported. Thus, the entire country can be assumed as being under lockdown. The value of A_S under the lockdown situation can be calculated using Eq. (17) as the slope of a plot of $\ln(P_F/P_{F0})$ against time. This plot is shown in Figure 7 for fifteen days into the lockdown.

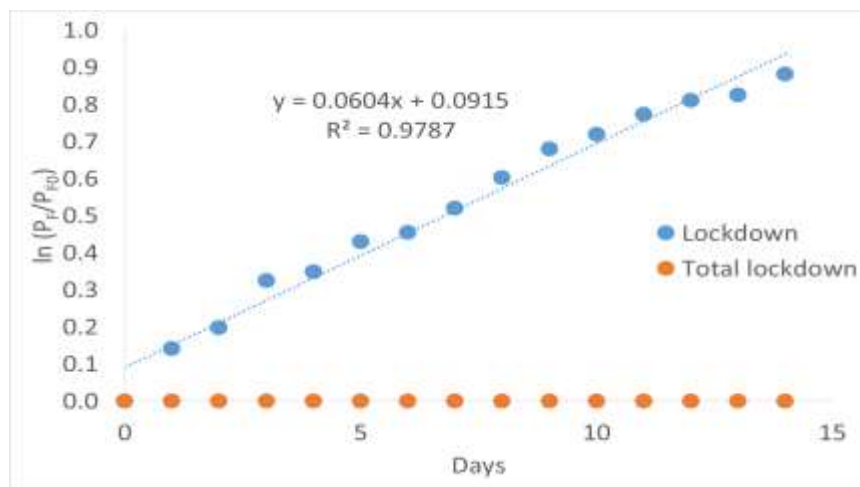


Figure 7: Correlation to determination the pseudo-rate constant under the lockdown situation and a total lockdown situation.

As expected, the slope value of 0.0604 per day, which is the value of A_S within the considered period is smaller than the value of 0.1706 for A_C , the latter decreasing to about one-third. However, if the social distancing of 2 m had been, A_C would have decreased to one-ninth, as shown in the previous section. Thus, the lockdown did not achieve the expected reduction in the spread of COVID-19.

From an r-squared value of 0.9787 in Figure 7, it can be inferred that the relationship between $\ln(P_F/P_{F_0})$ and time is becoming less linear. Furthermore, the points are randomly distributed. Thus, the model under a lockdown situation can be improved by introducing a nonlinear relationship and stochastic modelling.

Under a total lockdown, where $B_S = 2.42 \times 10^{-5}$, as shown in Figure 7, the transmission of COVID-19 is almost zero.

Conclusion

This article presented a model to predict the early part of the evolution of COVID-19 cases, a global pandemic that began in late 2019. The model was derived from the balance equation modelling. With simplifying assumptions of a closed society and negligible demographic growth rate, the model resulted in an exponential equation, yielding for the first time a simplified model able to mirror the exponential increase in confirmed cases of the pandemic.

Thereafter, the exponential rate constant was determined using data reported from China; its value 2.39 per fourteen days compared reasonably with the value of 2.2 reported elsewhere. Furthermore, the exponential equation yielded excellent predictions for data from China and Nigeria that satisfy its assumptions.

Furthermore, as the assumptions of the exponential equation are reasonable even under a lockdown situation, applying the equation therein for the data from Nigeria revealed the impact of the lockdown and in particular social distancing. While the lockdown decreased the spread of COVID-19, the decrease was minimal in comparison to the expected decrease with social distancing of 2 m, let alone the expected decrease under a total lockdown.

This modelling and its parameters can therefore be employed to check the effectiveness of various measures to mitigate the spread of COVID-19.

References

- Akinkuotu, E. 2018. With 87m poor citizens, Nigeria overtakes India as the poverty capital of the world, Punch Newspaper, Published June 26, 2018.
- Arfken, G.B., and Weber, H. 2007. Mathematical Methods for Physicists, 6th Edition, Academic Press, New Delhi.
- Bongaarts, J. 2009. Human population growth and the demographic transition, Phil. Trans. R. Soc. B (2009) 364, 2985–2990 doi:10.1098/rstb.2009.0137

- Bourouiba, L. 2020. "Turbulent Gas Clouds and Respiratory Pathogen Emissions: Potential Implications for Reducing Transmission of COVID-19". JAMA. doi:[10.1001/jama.2020.4756](https://doi.org/10.1001/jama.2020.4756). PMID 32215590.
- CDC (Centers for Disease Control and Prevention) 2 April 2020. "How COVID-19 Spreads". Archived from the original on 3 April 2020. <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-covid-spreads.html> Retrieved 3 April 2020.
- CSSE (The Center for Systems Science and Engineering), at Johns Hopkins University (JHU), 2020."COVID-19 Dashboard". ArcGIS. Johns Hopkins University. <https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6>, Retrieved 5 June 2020.
- Emorinken, M. 2020. "[COVID-19: UPDATED: First death recorded as confirmed cases rise to 36](#)". [The Nation Newspaper](#). Retrieved 23 March 2020.
- Gopinath, G. 2020. The Great Lockdown: Worst Economic Downturn Since the Great Depression, IMFBlog, International Monetary Fund, April 14, 2020, <https://blogs.imf.org/2020/04/14/the-great-lockdown-worst-economic-downturn-since-the-great-depression/>, Retrieved June 09, 2020.
- Guan, W., Ni, Z., Hu, Y., et al. 2020. Clinical characteristics of 2019 novel coronavirus infection in China, med Rxiv 2020. (doi: <https://doi.org/10.1101/2020.02.06.20020974>.)
- Harko, T., Lobo, F.S.N. and Mak, M.K. 2014. "Exact analytical solutions of the Susceptible-Infected-Recovered (SIR) epidemic model and of the SIR model with equal death and birth rates". Applied Mathematics and Computation. 236: 184–194. [arXiv:1403.2160](#). [Bibcode:2014arXiv1403.2160H](#). doi:[10.1016/j.amc.2014.03.030](https://doi.org/10.1016/j.amc.2014.03.030).
- Hethcote, H. 2000. "The Mathematics of Infectious Diseases". SIAM Review. 42 (4): 599–653. [Bibcode:2000SIAMR..42..599H](#). doi:[10.1137/s0036144500371907](https://doi.org/10.1137/s0036144500371907).
- ITDP (Institute for Transport and Development Policy), 2006. The Online BRT Planning Guide, 4th Edition, Section 25.6, <https://brtguide.itdp.org/branch/master/guide/brt-stations/station-dimensions>, Retrieved 11 June 2020
- Kermack, W.O. and McKendrick, A.G. (1927). "A Contribution to the Mathematical Theory of Epidemics". Proceedings of the Royal Society A. 115 (772): 700–721. [Bibcode:1927RSPSA.115..700K](#). doi:[10.1098/rspa.1927.0118](https://doi.org/10.1098/rspa.1927.0118).
- Laguipo, A.B.B. 2020. Human endemic coronavirus reinfection possible after recovery, News-Medical.Net, <https://www.news-medical.net/news/20200504/Human-endemic-coronavirus-reinfection-possible-after-recovery.aspx>, Retrieved 9 June 2020.
- Li, Q., Guan, X., Wu P., et al. 2020. Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia. N Engl J Med, doi: 10.1056/NEJMoa2001316.
- Liu, W., Yue, X.G. and Tchounwou, P.B. 2020. Response to the COVID-19 Epidemic: The Chinese Experience and Implications for Other Countries, Int. J. Environ. Res. Public Health 2020, 17, 2304; doi:[10.3390/ijerph17072304](https://doi.org/10.3390/ijerph17072304)
- Lu, H. 2020. Drug treatment options for the 2019-new coronavirus (2019-nCoV), Biosci Trends. (doi: [10.5582/bst.2020.01020](https://doi.org/10.5582/bst.2020.01020).)

- NCDC (Nigeria Centre for Disease Control), 2020. COVID-19 Nigeria, <https://covid19.ncdc.gov.ng/>
- Olajide, O.T. and Akinlabi, B. H., 2011. Agriculture Resource and Economic Growth in Nigeria, European Scientific Journal October edition vol. 8, No.22 ISSN: 1857 – 7881 (Print) e - ISSN 1857- 7431
- Oyeleke, S., 2020. ["UPDATED: Nigeria records second coronavirus death". The Punch Newspaper](#). Retrieved 30 March 2020.
- PSA (The Philippine Statistics Authority), 2016. Census of Population (2015). [Highlights of the Philippine Population 2015 Census of Population](#)., www.psa.gov.ph, Retrieved 20 June 2016.
- Pengfei Sun, P., Xiaosheng Lu, X., Xu, C., Sun, W. and Pan, B. 2020. Understanding of COVID-19 based on current evidence, J Med Virol., 92:548-551, doi: 10.1002/jmv.25722.
- Ravelo, J. L. and Jerving, S. 2020. Covid-19 – a Timeline of the coronavirus Outbreak, Inside Development, devex.com.
- Sandford, A., 2020. "Coronavirus: Half of humanity now on lockdown as 90 countries call for confinement". Euronews. <https://www.euronews.com/2020/04/02/coronavirus-in-europe-spain-s-death-toll-hits-10-000-after-record-950-new-deaths-in-24-hour>, Retrieved 3 April 2020.
- Shukman, D., 2020. Coronavirus: Could social distancing of less than two metres work?, BBC News, Science & Environment, <https://www.bbc.com/news/science-environment-52522460>, Retrieved 11 June 2020
- Spear, L. 2020. Guidance on the Role of ECMO in COVID-19 Treatment, RT Magazine, Apr 24,2020 <https://www.rtmagazine.com/disorders-diseases/critical-care/ecmo-covid-19-treatment/>, Retrieved 11 June 2020.
- UNESCO. 4 March 2020. "COVID-19 Educational Disruption and Response". Retrieved 28 March 2020.
- Velavan, T.P. and Meyer, C.G. 2020. "The COVID-19 epidemic". Tropical Medicine & International Health. 25 (3): 278–280. doi:10.1111/tmi.13383. PMC 7169770. PMID 32052514.
- Wang, W., Tang, J. and Wei, F. 2020. Updated understanding of the outbreak of 2019 novel coronavirus (2019-nCoV) in Wuhan, China, J Med Virol 2020. (doi: 10.1002/jmv.25689.)
- WHO (World Health Organization), 2020a. "Q&A on coronaviruses (COVID-19)". 17 April 2020. Archived from the original on 14 May 2020. Retrieved 14 May 2020.
- WHO, 2020b. "Advice for public", Archived from the original on 26 January 2020. Retrieved 25 February 2020.
- WHO, 2020c. WHO Director-General's opening remarks at the media briefing on COVID-19 - 24 February 2020, <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---24-february-2020>
- Worldometers 2020^a. Current World Population, <https://www.worldometers.info/world-population/#ref-1>, retrieved 11 June 2020
- Worldometers 2020^b. Countries in the world by population, <https://www.worldometers.info/world-population/population-by-country/>, retrieved 11 June 2020

Notations

Notation	Description	Units
A	pseudo-exponential rate constant	$1/day$
A_C	pseudo-exponential rate constant under congested society	$1/day$
A_S	pseudo-exponential rate constant under social distancing society	$1/day$
B	Constant susceptible population	$\#/m^2$
k_D	death rate constants	$1/day$
k_F	disease infection rate constants	m^2/day
k_G	the demographic growth rate of the society	$1/day$
k_R	recovery rate constants	$1/day$
P_i	Population density of i people	$\#/m^2$
P_F	Population density of infected people	$\#/m^2$
P_S	Population density of susceptible people	$\#/m^2$
r_i	rate of generation of i people per unit area from various events	$\#/(m^2 \cdot t)$
(r, θ, φ)	Spherical polar coordinates	$(m, ^\circ, ^\circ)$
S	Area of a society	m^2
t	Time	$days$

DRUG REPROFILING: PRELIMINARY *IN VITRO* ANTI-CANCER STUDY OF AMODIAQUINE ON MURINE AND HUMAN BREAST CANCERS

^{1,2}*Salako K.S., ³Radford D.C., ²Lian L. and ^{2,3}Jindřich K.

¹Department of Pharmaceutics and Pharmaceutical Technology, Faculty of Pharmacy, University of Lagos, P.M.B. 12003 Lagos, Nigeria.

²Department of Pharmaceutics and Pharmaceutical Chemistry, University of Utah, Salt Lake City, UT 84112, USA

³Department of Biomedical Engineering, University of Utah, Salt Lake City, UT 84112, USA.

*kobaweya@gmail.com

ABSTRACT

Cancer is a rapidly escalating disease and being one of the leading contributors to global disease burden, it constantly requires new therapeutic options. The development of new anticancer drugs has failed to keep up with the increasing incidence of cancer. Hence, drug reprofiling strategies are emerging as new therapeutic options. Amodiaquine is a mannich base 4-aminoquinoline anti-malarial drug with an analogous mode of action to that of chloroquine. Amodiaquine is emerging today as an indication in anti-cancer therapy. The aim of this study is to evaluate the anticancer activity of amodiaquine using murine and human breast cancer cell lines. In vitro cytotoxicity of amodiaquine against two breast cancer cell lines was evaluated. 4T1(murine) and MDA-MB-453 (human) cancer cells were incubated with the drug at different concentrations (0.781 μ M, 1.56 μ M, 3.13 μ M, 6.25 μ M, 12.50 μ M, 25.00 μ M, 50.00 μ M, 100.00 μ M) for 72 h, after which cell viability testing was conducted using the CCK-8 assay. The apoptotic capability of amodiaquine on MDA-MB-231 cells was also evaluated by flow cytometry using Annexin V/ Propidium iodide staining assay. The cytotoxicity studies showed that amodiaquine exhibited cytotoxic potential in 4T1 murine triple breast cancer cell lines with an IC_{50} of 10.50 μ M and MDA MB-453 human breast cancer cell lines with an IC_{50} of 6.48 μ M. The flow cytometry analysis of amodiaquine on MDA-MB-231 human triple negative breast cancer cells showed that amodiaquine is more likely to cause cell death by necrosis rather than by apoptosis. This study has been able to show that amodiaquine can potentially be reprofiled as an anti-cancer agent in the management of various breast cancer diseases like triple negative breast cancer as well as HER-2 positive / androgen receptor positive breast cancer. However, it is very important to develop amodiaquine as a targeted drug delivery system so as to avoid its possible necrotic effect on healthy cells and overcome some of its shortcomings with respect to short half-life, low tumor accumulation and side effects.

Key words: drug reprofiling, amodiaquine, cytotoxicity, cancer, flow cytometry

1.0 Introduction

According to the World Cancer Research Fund, breast cancer is the most prevalent malignancy in women worldwide and it is the second most common type of cancer. In 2018, there were over 2 million new cases of breast cancer (World Cancer Research Fund, 2018; Harbeck et al., 2019).

There are 3 main subtypes of breast cancer segmented by receptor expression profile (Lin et al., 2017). The first subtype is hormone receptor positive (expressing estrogen receptors and/or progesterone receptors (ER⁺/PR⁺) constituting 60% - 75 % of breast cancers (Cancer.Net, 2012). The second subtype is the human epidermal growth factor receptor 2 (HER2⁺) positive; it constitutes 10% - 20% of breast cancers (Cancer.Net, 2012). The third subtype is the triple negative subtype (breast cancers that do not express ER, PR, or HER2 receptor (ER⁻/PR⁻/HER2⁻). It constitutes 15% to 20% of breast cancers. (Cancer.Net, 2012; Diana et al., 2020; Lin et al., 2017).

Cancer is a rapidly escalating disease and being one of the leading contributors to global disease burden, it constantly requires new therapeutic options. The development of new anticancer drugs has failed to keep up with the increasing incidence of cancer. Hence, drug reprofiling strategies are emerging as new therapeutic options (Huang et al., 2018). Drug reprofiling can be described as a science driven process of identifying and discovering new therapeutic uses of already approved drugs (in current use or banned), outside the scope of their initial pharmacological indications (Moreira de Oliveira and Lang, 2018).

Drug reprofiling has many advantages over traditional de novo drug discovery approaches. First, it is often more cost effective (Lee and Kim, 2016). Second, there is reduction in development time (Placchi and Phillips, 2018). Third, higher success rates of drug discovery and development are being achieved compared to initial drug discovery and development (Agrawal, 2015; Nowak-Sliwinska et al., 2019). Lastly, repurposed drugs are good, quick alternatives for rare diseases that are life threatening, for example in the recent pandemic (COVID-19) where chloroquine and hydroxychloroquine were re-purposed and evaluated for possible disease management (Rosa and Santos, 2020).

Anti-malarial drugs have a long history of clinical use and tolerable safety profile (Taylor and White, 2004). They have been emerging as good targets for repurposing as anticancer drugs (Das, 2015). Amodiaquine is a mannich base 4-aminoquinoline anti-malarial drug with an analogous mode of action to that of chloroquine (Farrar et al., 2013). Amodiaquine is emerging today as an indication in anti-cancer therapy (Qiao et al., 2013; Espinoza et al., 2020). Therefore, the aim of this study is to evaluate the anticancer activity of amodiaquine using a combination of murine and human breast cancer cell lines.

2.0 Materials and methods

2.1 Drug Material

Amodiaquine dihydrate dihydrochloride (BOC Sciences, USA).

2.2 Chemicals and Reagents

Dimethyl sulfoxide (Sigma Life Science, France), Dulbecco's modified eagle medium IX (Gibco®-Thermo Fisher Scientific, USA), RPMI 1640 medium (Gibco®-Thermo Fisher Scientific, USA), Fetal bovine serum heat inactivated (Genesee scientific, USA), Cell counting kit-8 reagent (Dojindo Laboratories, Japan), FITC Annexin V (Biolegend® USA), Propidium iodide (Sigma-Aldrich, USA), Trypan blue stain 0.4% IX (Gibco®-Thermo Fisher Scientific, USA), 0.25 % Trypsin- EDTA IX (Gibco®-Thermo Fisher Scientific, USA), Phosphate buffered saline (Gibco®-Thermo Fisher Scientific, UK), Penicillin- Streptomycin (5000 U/mL) (Gibco® - Thermo Fisher Scientific, USA), Hydrochloric acid.

2.3 Apparatus/Equipment

Water Jacketed CO₂ Incubator (VWR Symphony™ 3074, USA), Biological safety cabinet (Forma Scientific Inc., USA), Tuttnauer autoclave (Brinkmann 3545M, USA), Flow cytometer (Cytex DXP 8 Analyzer, Cytex Biosciences Inc. USA), pH meter (accumet® BASIC, AB 15, Fisher Scientific, Germany), Hotplate/stirrer (VWR, USA), Standard mini vortexer (VWR, USA), Spectrafuge mini (C1301, SN 0504 0777, Korea), Plate reader (Infinite M200 PRO TECAN, Austria), Ultracentrifuge (Biofuge 22R, BAXTRA scientific product, Germany), Weighing balance (Spectrum® SCA 255AK, US), Water bath (IsoTemp® FS SWB 15; Thermo Fisher Scientific USA).

2.4 Cell Culture

Cell line and culture conditions: Triple negative cell lines of murine (4T1 cells) and human origin (MDA-MB-231 cells) as well as human cell line MDA-MB-453 were used for this research. All these cell lines were obtained from American Type Culture Collection (ATCC). 4T1 cells and MDA-MB-231 cells were cultured in RPMI-1640 medium supplemented with 10% fetal bovine serum heat inactivated and 1% penicillin- streptomycin, while MDA-MB-453 cells were cultured in Dulbecco's modified eagle medium (DMEM) IX, supplemented with 10% fetal bovine serum heat inactivated and 1% penicillin- streptomycin. These cells were maintained at 37 °C, in a humidified atmosphere with 5% CO₂.

2.5 *In vitro* Cytotoxicity of Amodiaquine on 4T1 Cells

The *in vitro* cytotoxicity of amodiaquine dihydrate dihydrochloride was assessed using the cell counting kit-8 assay, according to Tominaga et al. (1999) with some modifications. Cells were seeded (in triplicates) in a 96 well microplate (100 µl / well) at a density of 4000 cells per well in supplemented RPMI medium as described above. After 24 hours incubation at 37°C with 5% carbon dioxide, the cells were treated with 100 µL of known concentrations of amodiaquine dihydrate dihydrochloride (0.781 µM, 1.56 µM, 3.13 µM, 6.25 µM, 12.50 µM, 25.00 µM, 50.00 µM, 100.00 µM) in supplemented RPMI medium (pH 5.5). The cells were further incubated for 72 hours. The drug solutions were removed and the cells were washed with 100 µl of phosphate buffered saline for each well. Afterwards, 100 µl of CCK-8 solution (1:15 dilution in

supplemented RPMI medium) was added to each well and incubated for 1 hour, 40 min. The absorbance was measured using a plate reader at 450 nm (Tominaga et al., 1999). The cell viability was then calculated using the formula below:

$$\text{Percentage cell viability} = \frac{\text{Absorbance of treated} - \text{Absorbance of blank (media without drug and cells)}}{\text{Absorbance of control (media without drug)} - \text{Absorbance of blank}} \times 100$$

2.6 *In vitro* Cytotoxicity of Amodiaquine on MDA-MB-453 Cells

The *in vitro* cytotoxicity of amodiaquine dihydrate dihydrochloride was assessed using the cell counting kit-8 assay, according to Tominaga et al. (1999) with some modifications. Cells were seeded (in triplicates) in a 96 well microplate (100 µl / well) at a density of 10000 cells per well in supplemented DMEM medium as described above. After 48 hours incubation at 37°C with 5% carbon dioxide, the cells were treated with 100 µL of known concentrations of amodiaquine dihydrate dihydrochloride (0.781 µM, 1.56 µM, 3.13 µM, 6.25 µM, 12.50 µM, 25.00 µM, 50.00 µM, 100.00 µM) in supplemented DMEM medium. The cells were further incubated for 72 hours. The drug solutions were removed and the cells were washed with 100 µl of phosphate buffered saline for each well. Afterwards, 150 µl of CCK-8 solution (1:15 dilution in supplemented DMEM medium) was added to each well and incubated for 10 min. The absorbance was measured using a plate reader at 450 nm (Tominaga et al. 1999). The cell viability was then calculated using the formula below:

$$\text{Percentage cell viability} = \frac{\text{Absorbance of treated} - \text{Absorbance of blank (media without drug and cells)}}{\text{Absorbance of control (media without drug)} - \text{Absorbance of blank}} \times 100$$

2.7 Apoptotic Capability of Amodiaquine on MDA-MB-231 Cells

The apoptotic capability of amodiaquine on MDA-MB-231 cells was evaluated by flow cytometry using Annexin V/ Propidium iodide staining assay according to Kwan et al. (2016) with some modifications. Cells were seeded (in duplicate) in a 6 well microplate (1000 µL/ well) at a density of 100, 000 cells per well in supplemented RPMI 1640 medium. After 24 hours incubation at 37°C with 5% carbon dioxide, the cells were treated with 307 µM of amodiaquine dihydrate dihydrochloride (1000 µL) in supplemented RPMI 1640 medium (pH 5.5). The control group (in duplicate) was treated using media without drug.

The cells were further incubated for 72 hours. The cells were washed, detached with trypsin and centrifuged at 3000 rpm for 3 minutes in four eppendorf tubes and the supernatant was discarded. 400 µL of 0.0125% Annexin V (90 µg/mL) in PBS each was transferred into each Eppendorf tube containing the cell pellets and used to re-constitute the cells, then 2 µL of propidium iodide (50 µg /mL) each was also transferred to each Eppendorf tube and then was kept in the dark for fifteen minutes at ambient temperature. The stained cells were then analysed using a flow cytometer (Kswan et al., 2016).

2.8 Statistical Analysis

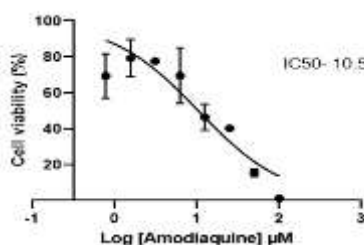
Quantitative data were managed in GraphPad Prism 8.30 (GraphPad Software, Inc., USA). Group data were analyzed using two-way analysis of variance (ANOVA) or paired t-test. The data were expressed as mean $\pm$ SD. Values of $P < 0.05$ were considered statistically significant.

3.0 Results

3.1 *In vitro* Cytotoxicity of Amodiaquine on 4T1 and MDA-MB-453 Cells

The *in vitro* cytotoxicity activity of amodiaquine on 4T1 and MDA-MB-453 cells has shown that the half maximal inhibitory concentration (IC_{50}) was 10.50 μ M and 6.48 μ M respectively.

(a)



(b)

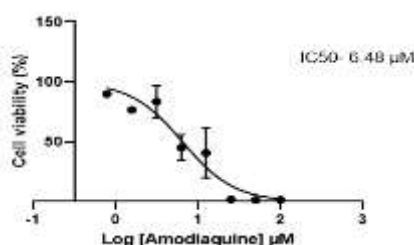
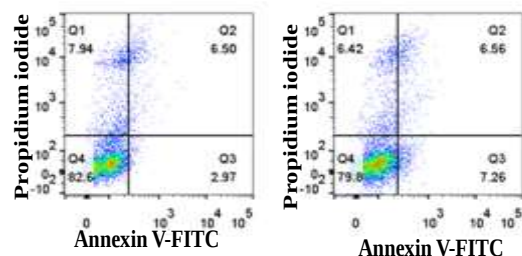


Fig. 1: (a) Inhibitory effects of amodiaquine on the growth of 4T1 cells. (b) Inhibitory effects of amodiaquine on the growth of MDA-MB-453 cell. Data were fitted with dose-response curve by using Graphpad Prism software. Data are expressed as means $\pm$ SD (n=3).

3.2 Apoptotic Activity of Amodiaquine on MDA-MB-231 cells

The apoptotic analysis of amodiaquine on triple negative MDA-MB-231 human breast cancer cells treated for 72 hours has shown activity of possible late apoptosis and secondary necrosis.

(a)



(b)

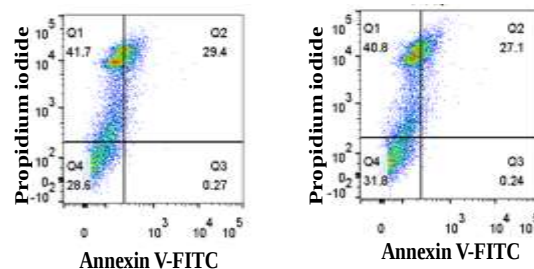


Fig. 2: (a) Annexin V- FITC / Propidium iodide assay on untreated MDA-MB-231 cells (Control) in duplicate. (b) Annexin V- FITC / Propidium iodide assay on treated MDA-MB-231 cells using 307 μ M of amodiaquine in duplicate.

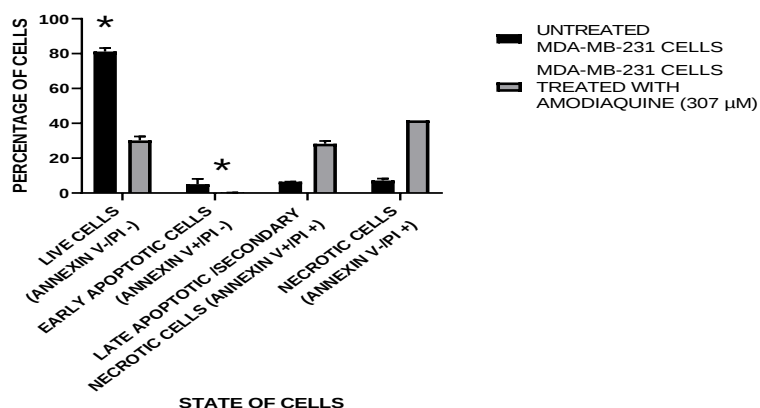


Fig. 3: Statistical analysis of Annexin V- FITC / Propidium iodide assay on untreated and treated MDA-MB-231 cells. Group data was analysed using two-way analysis of variance (ANOVA). Data are expressed as means $\pm$ SD (n=2, $P<0.05$).

3.3 Direct necrotic analysis using Propidium iodide

Direct necrotic analysis has shown that the percentage of direct necrotic cells from the treated group was 47.15 % while that of the untreated was 7.21 %.

(a)

(b)

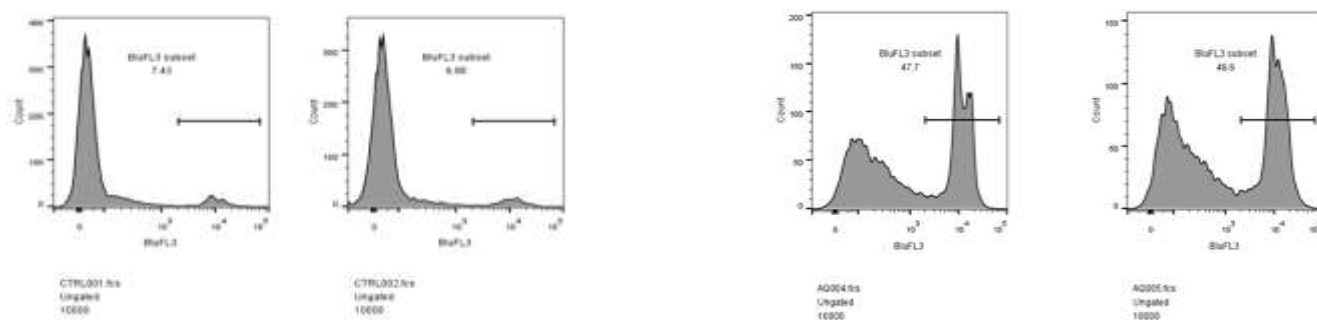


Fig. 4: (a) Direct necrotic analysis from Propidium iodide assay on untreated MDA-MB-231 cells (control) in duplicate. (b) Direct necrotic analysis from Propidium iodide assay on treated MDA-MB-231 cells using 307 µM of amodiaquine in duplicate.

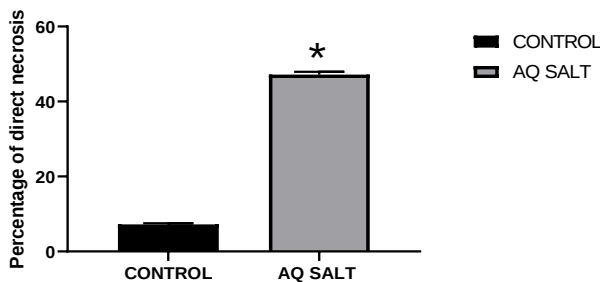


Fig. 5: Statistical analysis of direct necrosis using Propidium iodide. Group data was analysed using paired t-test. Data are expressed as means $\pm$ SD (n=2, $P<0.05$).

4.0 Discussion

Metastasis is the most lethal attribute of breast cancer and its treatment is still a challenge because of the limitations of remedial effects of the modalities available (Jiang et al., 2010). The *in vitro* cytotoxicity of amodiaquine on 4T1 cells has shown that amodiaquine was cytotoxic to these murine triple negative breast cancer cell lines with an IC_{50} of 10.50 μ M (Fig. 1a). This shows that amodiaquine is substantial enough to elicit anticancer effect on 4T1 cells which are usually very aggressive and have been found to have high metastatic potential. 4T1 cells can spontaneously metastasize from primary tumor in the mammary gland to multiple distant sites including lymph nodes, blood, bone, lung, liver, and brain (Yoo et al., 2017).

4T1 cancer cells are murine mammary carcinoma cells which are adherent and have an epithelial morphology. They usually form tumors and spontaneous metastases post implantation into syngeneic BALB/c mice or immunocompromised mice, thus they closely mimic stage IV human breast cancer expressing the heterogeneity of the human breast cancer disease. Therefore, they are good models for pre-clinical application of anticancer study (Yang et al., 2017).

This current cell viability study on 4T1 cells is comparable to another research work on the anticancer activity of chloroquine- an analogous compound to amodiaquine which showed that there was about 60 % inhibition rate on 4T1 cells at a concentration of 25 μ M after drug treatment for 72 hours (Jiang et al., 2010). This current study showed that the cell viability after 72 hours incubation with 25 μ M amodiaquine was 40.38 % (Fig. 1).

The *in vitro* cytotoxicity study of amodiaquine on MDA-MB-453 cells has also shown that amodiaquine was cytotoxic to MDA-MB-453 breast cancer cell lines with an IC_{50} of 6.48 μ M. (Fig. 1b). MDA-MB-453 breast cancer cell lines are androgen positive cells which also express human epidermal growth factor receptor 2 (HER-2). The cell line exhibits a characteristic apocrine carcinoma steroid receptor profile: ER- α -negative, PR-negative, and AR-positive (Vranic et al., 2011).

To the best of the author's knowledge, this is the first time that the cytotoxicity activity of amodiaquine has been conducted on MDA-MB-453 cells. However, a previous research study has shown that at a concentration of 100 μ M, chloroquine (an analogue of amodiaquine) has been shown to slightly decrease HER-2 levels in MDA-MB-453 cells, which means that chloroquine is cytotoxic to these cells since HER2 signaling help to mediate cell survival or proliferation in these breast cancer cells (Guo et al., 2019).

Increased proliferation in response to androgens is also a key feature of MDA-MB-453 cell lines. However, they can be blocked by anti-androgens, such as flutamide (Vranic et al., 2011). Therefore, if amodiaquine can elicit anticancer effect on MDA-MB-453 cells which are androgen receptor positive it is probable that amodiaquine can be repurposed in the treatment of diseases that are associated with androgen over-expression e.g. prostate cancer, acne, scalp hair loss, benign prostatic hyperplasia, pattern hair loss, hypersexuality, paraphilias, and rare disease like priapism.

The apoptotic analysis of amodiaquine on triple negative MDA-MB-231 human breast cancer cells has shown that there was a reduction in the number of viable cells in the Annexin V- / PI – (lower left) quadrant (Fig. 2) to 30.20 % (Fig. 3) when compared with the percentage of live cells

in the control which was 81.20 % (Fig. 3). At this point, it is expected that the cells are healthy and intact and there is no altered morphologic features like plasma membrane blebbing, plasma membrane asymmetry and attachment, chromatin condensation, nuclear fragmentation, and internucleosomal cleavage of DNA (Doherty and Baehrecke, 2018; Hingorani et al., 2011).

Thus, having only a few viable cells in the treated group showed that there is an obvious cell death being observed and that amodiaquine has cytotoxic effect against these human triple negative cancer cells which are very aggressive, invasive and metastatic in nature. Triple negative breast cancer has worse prognostic outcomes in many patients when compared with hormonal breast cancer and there are limited treatment options for this kind of breast cancer (Zwartsen et al., 2019).

The early apoptotic cells in the Annexin V+ / PI – (lower right) quadrant (Fig. 2) showed that the percentage of these cells was very insignificant (Fig. 3). It can therefore be inferred that amodiaquine did not induce early apoptosis on MDA-MB-231 cells. This might be due to the long term treatment of 72 hours, early apoptosis might have occurred after 24 hours or 48 hours. In apoptotic cells, the membrane phospholipid phosphatidylserine (PS) is translocated from the inner to the outer leaflet of the plasma membrane, thereby exposing PS to the external cellular environment and so one of the earliest features of apoptosis is loss of plasma membrane asymmetry (Hingorani et al., 2011). Annexin V is a 35–36 kDa Ca^{2+} -dependent phospholipid-binding protein with high affinity for PS. Annexin V can usually be conjugated to fluorochromes like fluorescein isothiocyanate (FITC) while retaining its high affinity for PS and thus serves as a sensitive probe for flow cytometric analysis of cells undergoing apoptosis by binding to exposed apoptotic cell surface (Hingorani et al., 2011).

The late apoptotic / secondary necrotic cells in the Annexin V+ / PI + (upper right) quadrant (Fig. 2) showed that percentage of the cells was 28.25 % (Fig. 3) after treatment with amodiaquine, while the untreated control was 6.53 % (Fig. 3). PS translocation that causes loss of membrane asymmetry in early apoptosis precedes the loss of membrane integrity, which accompanies the later stages of cell death resulting from either apoptotic or necrotic processes, thus late apoptosis or secondary necrosis will occur because of loss of plasma membrane integrity since PI which is a DNA-binding dye molecule, can only enter cells with ruptured membranes (Hingorani *et al.*, 2011). During late apoptosis / secondary necrosis, annexin can also enter the ruptured membrane and bind to the PS that are also left inside the cells thereby creating a false positive result (JoVE, 2020). Hence, to confirm apoptosis in this experiment, it is necessary to further measure apoptosis by caspase 3 activity (McComb *et al.*, 2019).

The necrotic cells in the Annexin V- / PI + (upper left) quadrant (Fig. 2) showed that the percentage of the cells was 41.70 % (Fig. 3) after treatment with amodiaquine, while the untreated control was 7.18 % (Fig. 3). This showed that one of the mechanisms by which amodiaquine elicits its anti-cancer activity is possibly by induction of necrosis. Propidium iodide cannot penetrate viable cells because they possess intact membranes. However, the membranes of dead and damaged cells are permeable to PI (Moo-Young, 2019; Rosenberg et al., 2019). The percentage of Annexin V- / PI + cells will contain both dead (necrotic cells) and damaged cells.

Therefore, the exact percentage of necrotic cells present was analysed using the direct necrosis analysis by propidium iodide.

The direct necrosis analysis (Fig. 4) showed that the percentage of direct necrotic cells from the treated group was 47.15 % (Fig. 5) while that of the untreated was 7.21 % (Fig. 5). This gives a more complete picture of the necrotic activity of propidium iodide because of the exclusion of damaged cells or cell debris that may be present in the Annexin V- / PI + cells previously analyzed.

Although amodiaquine shows potential anti- cancer activity *in vitro*, however, as a small molecular drug, it has some shortcomings *in vivo* (short half-life, low tumor accumulation, side effects, etc.) (Mócsai et al., 2014; Labclinics, 2019). Thus, the need for a macromolecular targeted drug delivery system to fully realise the anticancer potential *in vivo* and in clinical applications. Therefore, this study is a basis for the anticancer targeted delivery of amodiaquine using *N*-(2-Hydroxypropyl) methacrylamide conjugate.

5.0 Conclusion

This study has been able to show that amodiaquine can potentially be reprofiled as an anti-cancer agent in the management of various breast cancer diseases like triple negative breast cancer as well as HER-2 positive / androgen receptor positive breast cancer. However, it is very important to develop amodiaquine as a targeted drug delivery system so as to avoid its possible necrotic effect on healthy cells and overcome some of its shortcomings with respect to short half-life, low tumor accumulation and side effects. Also, more *in vitro* and *in vivo* studies are required to further validate these claims.

References

- Agrawal, P. 2015. Advantages and Challenges in Drug Re-Profiling. J. Pharmacovigil. s2. <https://doi.org/10.4172/2329-6887.S2-e002>
- Cancer.Net 2012. Breast Cancer - Introduction. <https://www.cancer.net/cancer-types/breast-cancer/introduction> (accessed 4.20.20).
- Das, A. 2015. Anticancer Effect of AntiMalarial Artemisinin Compounds. Ann. Med. Health Sci. Res. 5, 93–102. <https://doi.org/10.4103/2141-9248.153609>
- Diana, A., Carlino, F., Franzese, E., Oikonomidou, O., Criscitiello, C., De Vita, F., Ciardiello, F. and Orditura, M. 2020. Early Triple Negative Breast Cancer: Conventional Treatment and Emerging Therapeutic Landscapes. Cancers 12, 819. <https://doi.org/10.3390/cancers12040819>
- Doherty, J. and Baehrecke, E.H. 2018. Life, death and autophagy. Nat. Cell Biol. 20, 1110–1117. <https://doi.org/10.1038/s41556-018-0201-5>
- Espinoza, J.A., Zisi, A., Kanellis, D.C., Carreras-Puigvert, J., Henriksson, M., Hühn, D., Watanabe, K., Helleday, T., Lindström, M.S. and Bartek, J. 2020. The antimalarial drug amodiaquine stabilizes p53 through ribosome biogenesis stress, independently of its autophagy-inhibitory activity. Cell Death Differ. 27, 773–789. <https://doi.org/10.1038/s41418-019-0387-5>

- Farrar, J., Hotez, P.J., Junghanss, T., Kang, G., Lalloo, D. and White, N.J. 2013. *Manson's Tropical Diseases E-Book*. Elsevier Health Sciences.
- Guo, G., Zhang, W., Dang, M., Yan, M. and Chen, Z. 2019. Fisetin induces apoptosis in breast cancer MDA-MB-453 cells through degradation of HER2/neu and via the PI3K/Akt pathway. *J. Biochem. Mol. Toxicol.* 33, e22268. <https://doi.org/10.1002/jbt.22268>
- Harbeck, N., Penault-Llorca, F., Cortes, J., Gnant, M., Houssami, N., Poortmans, P., Ruddy, K., Tsang, J. and Cardoso, F. 2019. Breast cancer. *Nat. Rev. Dis. Primer* 5, 1–31. <https://doi.org/10.1038/s41572-019-0111-2>
- Hingorani, R., Deng, J., Elia, J., McIntyre, C. and Mittar, D. 2011. Detection of Apoptosis Using the BD Annexin V FITC Assay on the BD FACSVersTM System 12.
- Huang, J., Zhao, D., Liu, Z. and Liu, F. 2018. Repurposing psychiatric drugs as anti-cancer agents. *Cancer Lett.* 419, 257–265. <https://doi.org/10.1016/j.canlet.2018.01.058>
- Jiang, P.D., Zhao, Y.L., Deng, X.Q., Mao, Y.Q., Shi, W., Tang, Q.Q., Li, Z.G., Zheng, Y.Z., Yang, S.Y. and Wei, Y.Q. 2010. Antitumor and antimetastatic activities of chloroquine diphosphate in a murine model of breast cancer. *Biomed. Pharmacother. Biomedicine Pharmacother.* 64, 609–614. <https://doi.org/10.1016/j.biopha.2010.06.004>
- JoVE, 2020. Annexin V and Propidium Iodide Labeling. JoVE Science Education Database [WWW Document]. URL <https://www.jove.com/science-education/5650/annexin-v-and-propidium-iodide-labeling> (accessed 4.19.20).
- Kwan, Y.P., Saito, T., Ibrahim, D., Al-Hassan, F.M.S., Oon, C.E., Chen, Y., Jothy, S.L., Kanwar, J.R. and Sasidharan, S. 2016. Evaluation of the cytotoxicity, cell-cycle arrest, and apoptotic induction by *Euphorbia hirta* in MCF-7 breast cancer cells. *Pharm. Biol.* 54, 1223–1236. <https://doi.org/10.3109/13880209.2015.1064451>
- Labclinics, 2019. Small molecule inhibitors as emerging cancer therapeutics. *Small Mol. Inhib. Emerg. Cancer Ther.* URL <https://www.labclinics.com/en/small-molecules-inhibitors-as-emerging-cancer-therapeutics/> (accessed 4.27.20).
- Lee, H.-M. and Kim, Y. 2016. Drug Repurposing Is a New Opportunity for Developing Drugs against Neuropsychiatric Disorders. *Schizophr. Res. Treat.* 2016. <https://doi.org/10.1155/2016/6378137>
- Lin, G., Zhu, S., Wu, Y., Song, C., Wang, W., Zhang, Y., Chen, Y.L. and He, Z. 2017. ω -3 free fatty acids and all-trans retinoic acid synergistically induce growth inhibition of three subtypes of breast cancer cell lines. *Sci. Rep.* 7, 1–10. <https://doi.org/10.1038/s41598-017-03231-9>
- McComb, S., Chan, P.K., Guinot, A., Hartmannsdottir, H., Jenni, S., Dobay, M.P., Bourquin, J.-P. and Bornhauser, B.C. 2019. Efficient apoptosis requires feedback amplification of upstream apoptotic signals by effector caspase-3 or -7. *Sci. Adv.* 5, eaau9433. <https://doi.org/10.1126/sciadv.aau9433>
- Mócsai, A., Kovács, L. and Gergely, P. 2014. What is the future of targeted therapy in rheumatology: biologics or small molecules? *BMC Med.* 12, 43. <https://doi.org/10.1186/1741-7015-12-43>
- Moo-Young, M. 2019. Flow cytometry: A high- throughput technique for microbial bioprocess characterization. *Comprehensive Biotechnology*, Third. ed. Elsevier.
- Moreira de Oliveira, E.A. and Lang, K.L. 2018. Drug Repositioning: Concept, Classification, Methodology, and Importance in Rare/Orphans and Neglected Diseases. *J. Appl. Pharm. Sci.* 8, 157–165. <https://doi.org/10.7324/JAPS.2018.8822>
- Nowak-Sliwinska, P., Scapozza, L. and Altaba, A.R. 2019. Drug repurposing in oncology: Compounds, pathways, phenotypes and computational approaches for colorectal cancer.

- Biochim. Biophys. Acta Rev. Cancer 1871, 434–454.
<https://doi.org/10.1016/j.bbcan.2019.04.005>
- Placchi, M. and Phillips, R. 2018. Benefits and Pitfalls of Repurposing Drugs [WWW Document]. VOLT®. URL <https://oliver-dev.s3.amazonaws.com/2018/11/07/21/59/08/240/Benefits%20and%20Pitfalls%20of%20Repurposing%20Drugs.pdf> (accessed 4.19.20).
- Qiao, S., Tao, S., Rojo de la Vega, M., Park, S.L., Vonderfecht, A.A., Jacobs, S.L., Zhang, D.D. and Wondrak, G.T. 2013. The antimalarial amodiaquine causes autophagic-lysosomal and proliferative blockade sensitizing human melanoma cells to starvation- and chemotherapy-induced cell death. *Autophagy* 9, 2087–2102.
<https://doi.org/10.4161/auto.26506>
- Rosa, S.G.V. and Santos, W.C. 2020. Clinical trials on drug repositioning for COVID-19 treatment. *Rev. Panam. Salud Pública* 44. <https://doi.org/10.26633/RPSP.2020.40>
- Rosenberg, M., Azevedo, N.F. and Ivask, A. 2019. Propidium iodide staining underestimates viability of adherent bacterial cells. *Sci. Rep.* 9, 1–12. <https://doi.org/10.1038/s41598-019-42906-3>
- Taylor, W.R.J. and White, N.J. 2004. Antimalarial Drug Toxicity. *Drug Saf.* 27, 25–61.
<https://doi.org/10.2165/00002018-200427010-00003>
- Tominaga, H., Ishiyama, M., Ohseto, F., Sasamoto, K., Hamamoto, T., Suzuki, K. and Watanabe, M. 1999. A water-soluble tetrazolium salt useful for colorimetric cell viability assay. *Anal. Commun.* <https://doi.org/10.1039/a809656b>
- Vranic, S., Gatalica, Z. and Wang, Z.Y. 2011. Update on the molecular profile of the MDA-MB-453 cell line as a model for apocrine breast carcinoma studies. *Oncol. Lett.* 2, 1131–1137.
<https://doi.org/10.3892/ol.2011.375>
- World Cancer Research Fund, 2018. Breast cancer statistics. *World Cancer Res. Fund.* URL <https://www.wcrf.org/dietandcancer/cancer-trends/breast-cancer-statistics> (accessed 4.20.20).
- Yang, Y., Yang, H.H., Hu, Y., Watson, P.H., Liu, H., Geiger, T.R., Anver, M.R., Haines, D.C., Martin, P., Green, J.E., Lee, M.P., Hunter, K.W. and Wakefield, L.M. 2017. Immunocompetent mouse allograft models for development of therapies to target breast cancer metastasis. *Oncotarget* 8, 30621–30643.
<https://doi.org/10.18632/oncotarget.15695>
- Yoo, B., Kavishwar, A., Wang, P., Ross, A., Pantazopoulos, P., Dudley, M., Moore, A. and Medarova, Z. 2017. Therapy targeted to the metastatic niche is effective in a model of stage IV breast cancer. *Sci. Rep.* 7, 1–9. <https://doi.org/10.1038/srep45060>
- Zwartsen, A., Chottanapund, S., Kittakoop, P., Navasumrit, P., Ruchirawat, M., Van Duursen, M.B.M. and Van den Berg, M. 2019. Evaluation of anti-tumour properties of two depsidones – Unguinol and Aspergillusidone D – in triple-negative MDA-MB-231 breast tumour cells. *Toxicol. Rep.* 6, 1216–1222. <https://doi.org/10.1016/j.toxrep.2019.10.012>

PRODUCTION OF CONNECTING ROD FROM WASTE ALUMINIUM CANS FOR AUTOMOBILE APPLICATION

***Agunsoye Johnson Olumuyiwa and Anyanwu Joachin Eberechukwu**

Department of Metallurgical and Materials Engineering

University of Lagos, Nigeria

*jagunsoye@unilag.edu.ng

ABSTRACT

According to Global Reports on Human Settlements, one third to one half of solid wastes generated in most developing nations is indiscriminately dumped on waste lands and streets. Indiscriminate disposal of waste Aluminium Cans often result in sewage blockage and over flooding of major roads in Lagos metropolis especially during rainy seasons. The combined effect of these lead to heavy traffic and environmental pollution with loss of man-hour. This study seeks to convert through foundry recycling, Aluminium Waste Cans blended with particulate processed agro waste periwinkle shell to produce a prototype indigenous tricycle connecting rod. Sample periwinkle shell was milled in a ball mill to nanoparticle size and blended with Waste Aluminium Cans. The blend was melted at 671°C in a Graphite based oil fired crucible furnace, poured into an improvised permanent die mould and allowed to solidify at room temperature. The cast samples were machined to a specified prototype drawing and some selected sample representative were taken for characterisation to ascertain its microstructural particle size using Scanning Electron Microscope (SEM), and Transmission Electron Microscope (TEM) respectively. The phases present were revealed from the X-Ray Diffraction test. Universal tensile machine was used to obtain the tensile properties. From the TEM results, 39.7 nm was obtained as the optimum nanoparticle size at 74 hours post classification milling. In conclusion, this study has confirmed the suitability of waste periwinkle shells and recycled Aluminium Cans as suitable engineering materials for the production of tricycle connecting rod. The addition of 39.7 nm particulate periwinkle shell to recycled Aluminium Cans has improved the tensile properties by 95.45% compared to the control sample. This study therefore represents a novel contribution to environmental sustainability by the conversion of waste to wealth.

Keywords: Production, Connecting Rod, Agro waste nanoparticles, Mechanical Properties

Introduction

The Indiscriminate disposal of Aluminium Cans (see Figure 1) which has often resulted in sewage blockage, over flooding of major roads in Lagos metropolis especially during rainy seasons, usually result in heavy traffic and loss of man-hour. These waste Aluminium Cans when collected, are a viable source of raw material for the production of useful engineering materials.

Currently, these wastes are being converted into sacrificial anodes for protection of structures from corrosion especially in the oil and gas industry. Local foundry shops also recycle Aluminium Cans into ingots and sell to large scale foundries, which in turn purify it and sell to motor cycle companies in Asia as raw materials. Some aluminium companies use it to produce aluminium buckets and cooking utensils. It is also used for ornamental castings for decoration of houses and public buildings. Hence, the economic potentials of these Aluminium Cans (Al-Cans) are very huge.



Figure 1: (Discarded Al-Cans (b) Recovered Al-Cans for recycling

Despite the numerous uses of these Al-Cans, the United States Environmental Protection Agency (EPA): 2015 Fact Sheet, reported that, only 18.5% of the total Aluminium wastes generated yearly were recovered for recycling, leaving as high as 81.5% unutilized (see Figure 2). According to Douglas et al. (1986), findings have shown that Aluminium Cans and other beverage containers and closure constitute up to 52% of roadside litter, 42% in waterways, and an average of 49% of litter at all sites. Recycling Aluminium Cans therefore, represents a high percentage source of secondary Aluminium for production of various Al-composites. Spectrometer analysis results from this study (see Table 1) show that the composition of the recycled Al-Cans after two stage homogenization is equivalent to ASTM5053 specification. It has been established from literature that this composition is non heat treatable, and this property makes its structure to be very stable to a reasonably higher operating temperature. However, the mechanical property of Al-can is low, but can be enhanced with particulate carbonized periwinkle shells in order to use it for production of components such as connecting rod and piston.

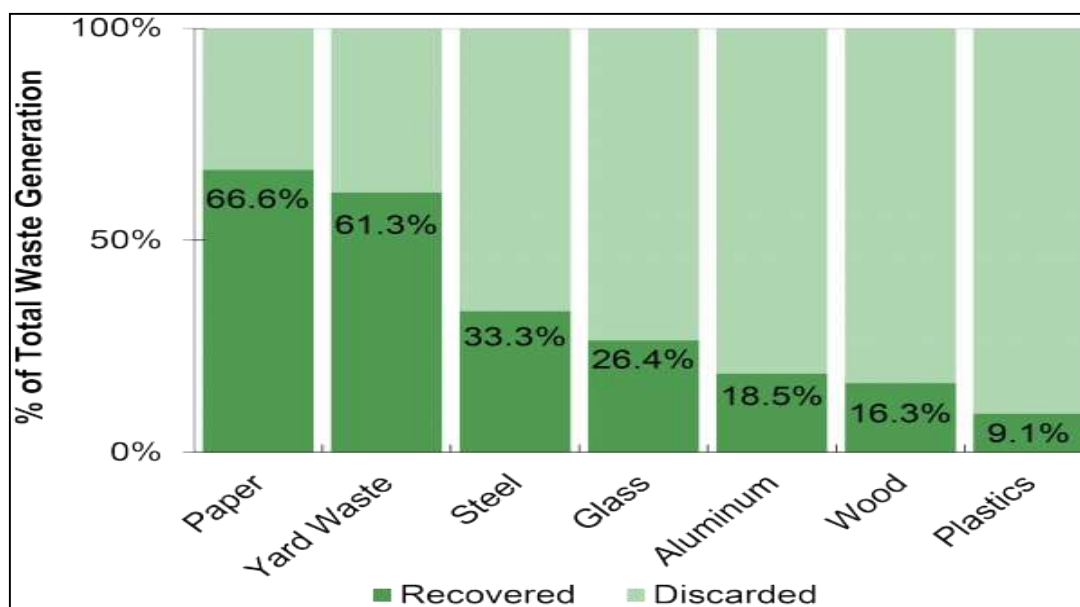


Figure 2: % Waste Recovered and Discarded (U.S. Environmental Protection Agency 2015 Fact Sheet)

Table 1: Upper and lower compositional analysis of recycled aluminium ingot (%)

	Al	Si	Cu	Mn	Mg	Zn	Cr	Ti	Zr
Upper limit	98.08	0.60	0.39	1.263	1.48	0.09	0.025	0.0413	0.138
Lower limit	93.28	0.455	0.30	0.76	0.89	0.053	0.015	0.025	0.083

Recent literature works according to Aku et al. (2012), revealed that a number of agro wastes such Bean shell wastes (BSW), Corncob (CC), Maize stalk (MS), rice husk (RH), Coconut shell (CNS), Periwinkle shell (PWS), Egg shells (ES), Orange peel (OP), and Palm kernel shell (PKS), can be harnessed and processed for use as particulate filler reinforcements of composites. In particular, periwinkle shells (medicinal uses of periwinkle include increasing blood circulation in the brain, supporting brain metabolism, increasing mental productivity, preventing memory and concentration problems and feebleness, improving memory and thinking ability, and preventing early aging of brain cells) are often discarded after consumption of the edible parts, thereby constituting pollutants that alter the aesthetic beauty of our environment. Large deposits of periwinkle shells (PWS) have been reported in communities such as Oron, Okobo, IkotOffong, Itu, Issiet, Uta-ewea, Cross river, Edo and Bayelsa State (Jamabo and Chinda, 2010). About 40.3 tonnes of periwinkle are harvested from about 35 mangrove communities of Rivers and Delta States of Nigeria (Mmom and Arokoya, 2010). Benson (2008) reported abundant availability of common periwinkle in the northern coasts of the Atlantic Ocean including northern Spain, France, England, Wales, Scotland, Ireland, Scandinavia and Russia. According to Ajibade (2019), PWS can be carbonised to obtain activated carbon. He also noted that apart from being

highly stable in terms of oxidation, it has a glass transition temperature of approximately 680°C. PWS contains calcium carbonate (93%), Silicate (3.5%) and trace of other elements such as aspartic acid, glycine, phosphate, zinc, magnesium and aluminium (Aku et al., 2012). These attributes make particulate PWS a suitable candidate filler material for the improvement of mechanical properties of aluminium metal matrix. Using the concept of diffusion, particulate PWS at nanolevel in its simplest form can diffuse into molten aluminium by random atomic jump from one position to another. This atomic jump depends on the exponential function of temperature. As the jump frequency increases, diffusion flux increases in accordance to equation 1 below.

$$J = D \left(\frac{C_1 - C_2}{\Delta x} \right) \quad (1)$$

D = diffusion coefficient (cm²/s), J= diffusion flux (Kg/m³-s), Δx = Distance between the particles radii

The diffusion coefficient contains the informative temperature dependency of the frequency. Equation 1 can be modified thus:

$$J = -D \left[\frac{dc}{dx} \right] \quad (2)$$

From the two equations above it can be seen that diffusion is a function of concentration and the distance between the radii of the particles. Therefore, the nanoparticles of the PWS are expected to diffuse easily within the molten Aluminium.

Automotive and aviation internal combustion engines require cost effective, lighter materials with increased strength to weight ratio, for easy handling, optimal efficiency in service and fuel economy (Rino et al., 2012). Consequently, lighter aluminium alloy based composites are now replacing heavy structural and non-structural materials for the production of automobile parts such as connecting rod, sprocket and pistons (Wieletal.,2012). Connecting rod is a highly dynamically loaded major component of automotive internal combustion engine that undergoes high cyclic load of order 10⁸ to 10⁹ cycles. It is often subjected to high tensile, compressive and torsional stress under lubrication (Pathade et al., 2012). It represents the linking mechanism of energy transfer from the rotational crankshaft to a reciprocating linear motion of the piston (Saheed et al., 2014). From the view point of functionality, connecting rod must have the highest possible rigidity at the lowest weight (Prayank et al., 2013). Manufacturing methods includes forging and casting.

In this present work the need for cheaper and more readily available alternative source of aluminium ingot and the suitability of waste periwinkle shell nanoparticle as reinforcement for improving the tensile properties of aluminium alloy has been exploited for the production of Tricycle connecting rod. This study seeks to convert through foundry recycling; Aluminium Wastes Cans blended with mechanically processed Nano particulate agro waste PWS to produce

Tricycle Connecting rod. Therefore, this study represents a novel contribution to environmental sustainability by the conversion of wastes to wealth

Methodology

Materials and Equipment

Discarded Aluminium cans used in this study were sourced and collected from Waste Management Centre of University of Lagos, while Periwinkle shells used for reinforcement were procured from foodstuff vendors at the popular Boundary market in Ajeromi Ifelodun Local Government Area of Lagos State, Nigeria. Equipment used include Electric Furnace, Disc Grinding Machine, Digital weighing scale, and set of sieves with sine shaker, Planetary/Tumbler Ball Mills, crucible pot. Scanning Electron Microscope (SEM), X-Ray Diffractometer (XRD), Transmission Electron Microscope (TEM) and Gwydion software, were used for characterization of the composites.

Methods

Synthesis of Periwinkle Shell Nanoparticles

Periwinkle shells (6 kg) were soaked in water, rinsed and oven dried using Uniscope Laboratory Oven (Model/serial no: SM 9053/1302271 at 50°C for 20 minutes. Thereafter the periwinkle shells were crushed and milled at Federal Institute of Industrial Research Oshodi (FIIRO) using Broyeur Clero hammer crusher, (Model/serial no: 000T/13634) into particle size ranging from 650-45 μm . The agro waste powder retained below 45 μm was used as the feed powder for synthesis of periwinkle shell nanoparticles. Ball milling of PWS samples was carried out for 74 hours at 10 charge ratio and 195 revolutions per minute (rpm) using ceramic balls of similar size ranges (5-70) mm. A tightly packed Flender Himmel electric motor powered Tumbler Ball Mill (Model A50A2043) was used for the ball milling. Particle morphology were examined using ASPEX 30120 Scanning Electron Microscope (SEM -Model: SIRIUS 50/3.8) and Valeta Transmission Electron Microscope (TEM). Identification of the phases was studied with Empyrean X-Ray Diffractometer (XRD).

Melting of Waste Aluminium Cans

Two stage smelt homogenization technique was used to produce the aluminium alloy ingot used as the matrix material for this study. In the first stage, 6 kg of Aluminium Wastes Cans was melted at 671°C in a graphite based Oil Fired Crucible Furnace, and poured into an improvised pre-heated permanent Die mould (see Fig. 3a) mm and allowed to solidify to room temperature. The yield of the melt was approximately 60%. Since Aluminium Cans was made up of different brands i.e. Coca cola, Fanta, Highmalt, Bullet, Maltex, Amstel, the possibility of slight variation in chemical composition is feasible. To ensure homogenization in chemical composition, ingots produced from the first stage melt were re-melted for proper homogenization, poured into a pre-heated permanent die mould and allowed to solidify to room temperature before knocking out. Figure 3 shows the sequence of production.



(a)



(b)



(c)



(d)



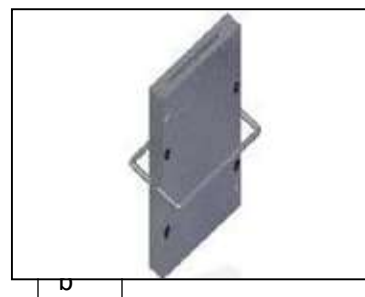
(e)



(f)

Figure 3: (a-b) Al-Cans (compacted Cans (c) Melting (d) Die mould (e) Pouring (f) Cast Ingots

Production of connecting rod Stir casting process was employed for the production of aluminium and periwinkle shell (Al/PWS) nanocomposite based connecting rod. A pit furnace with ladle capacity of 15kg was used to re-melt the waste aluminium Cans until it has become molten. The melt temperature was taken with a deep stick pyrometer shell. The Al/PWS blend was stirred for 30s and then poured into a preheated die mould and allowed to cool and solidify at room temperature. The cast connecting rods were machined to a specified prototype drawing and some selected sample representatives were taken for characterisation to examine its microstructure. Figure 4 shows the production route of the Al/PWS nanocomposite based Connecting rod.



Tensile property

Figure 5 represents the machined tensile specimen taken as sample representative from the cast, using Instron tensile machine with model 3369; and system ID: 3369S3457 at a strain rate of $0.0001(1 \times 10^{-4})\text{s}^{-1}$



Figure 5: Tensile test samples

Results and Discussion

TEM/EDS and XRD of Periwinkle Shell Nanoparticles

1. Figure 6 represent the TEM micrograph test result obtained t after 74 hrs ball milling of periwinkle shell. It can be seen that the periwinkle shell has reached Nano particle range size. (39.7) nm average. The Energy Dispersive X-Ray Spectroscopic analysis revealed the presence of C, O, Mg, Ca, and Cu with Ca as a major element present in PWS. XRD diffract grams of PWS nanoparticles 6 and 7 with major diffraction peaks at angle (2θ) of 29.39° , 47.50° and 39.40° and inter-planar distances of $3.04\text{\AA}$, $1.191\text{\AA}$, $2.29\text{\AA}$ and relative x-ray diffracting intensities of 100.00, 16.08 and 15.95 (see Figure 6 and 7) The respective phases at these peaks are $\text{Ca}(\text{CO}_3)$, $(\text{Ca}, \text{Mg})\text{CO}_3$ and CuO . Both Energy Dispersive X-ray Spectroscopic Analysis and XRD indicates Ca as a major element present in PWS. These elements (Ca) exists as carbonate [$\text{Ca}(\text{CO}_3)$ and $(\text{Ca}, \text{Mg})\text{CO}_3$] as shown on in Table 2 and figure 10 respectively.

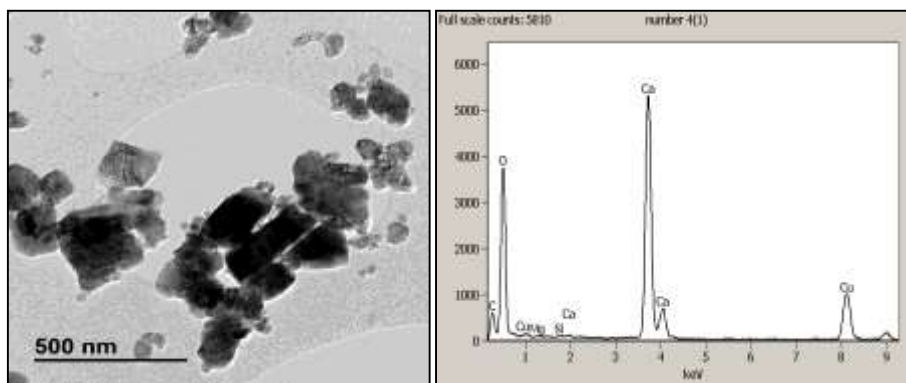


Figure 6: TEM/EDS Periwinkle Shell Nanoparticles

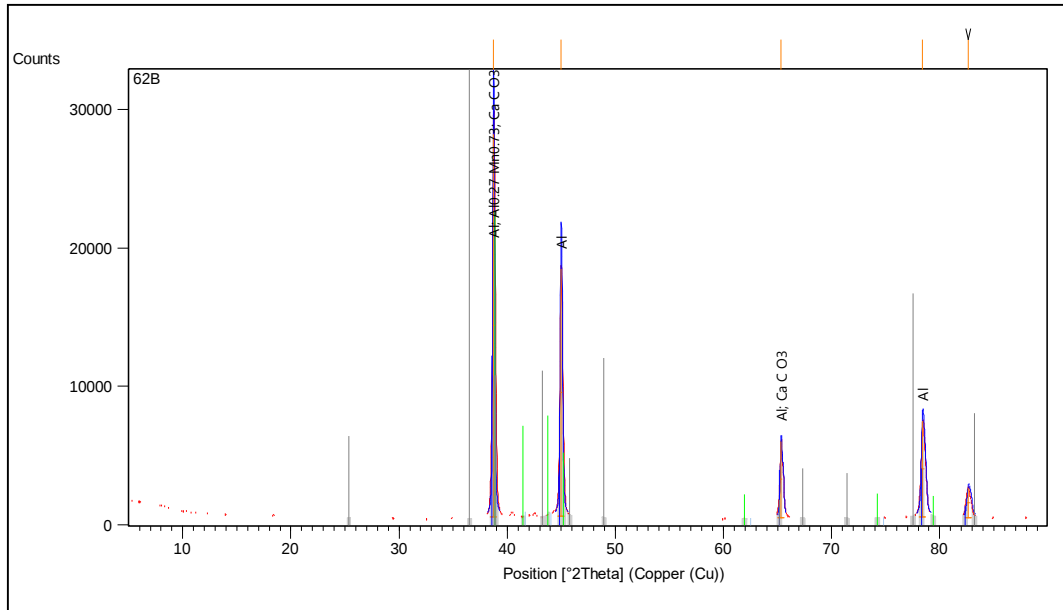
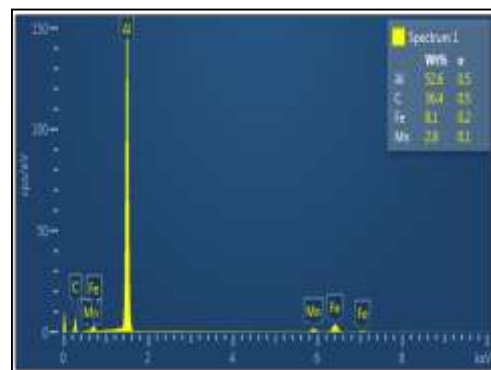
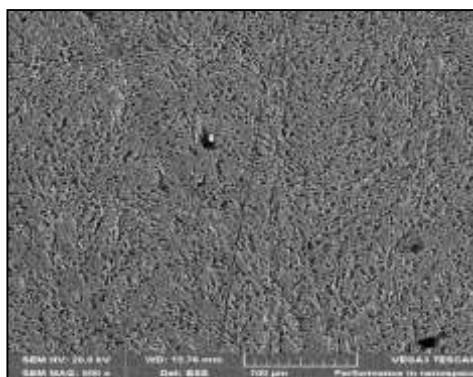


Figure 7: XRD of Periwinkle shell nanoparticle

SEM/EDS Spectrograph and XRD diffract gram of connecting rod

Figure 8 and 9 represent the SEM/EDS micrograph for both control and Al+2wt. % PWS composite. The micrograph in figure 9 shows uniform distribution of activated carbon within the matrix of the microstructure of the connecting rod. From the micrograph it can be deduced that the periwinkle nanoparticles diffused uniformly within the matrix. Table 2 shows the different phases with their Compound names and Chemical formula present in the control sample and the 2wt. %CPWS nanocomposite based connecting rod. It can be seen clearly from the table the distinct phases that are responsible for the improvement in hardness of the composite. Some of the phases include Aluminum manganese ($\text{Al}_{0.27}\text{Mn}_{0.7}$) and Calcium Carbonate (CaCO_3). These phases may be partly responsible for the increase in hardness value as well as the improved tensile properties of the composite.



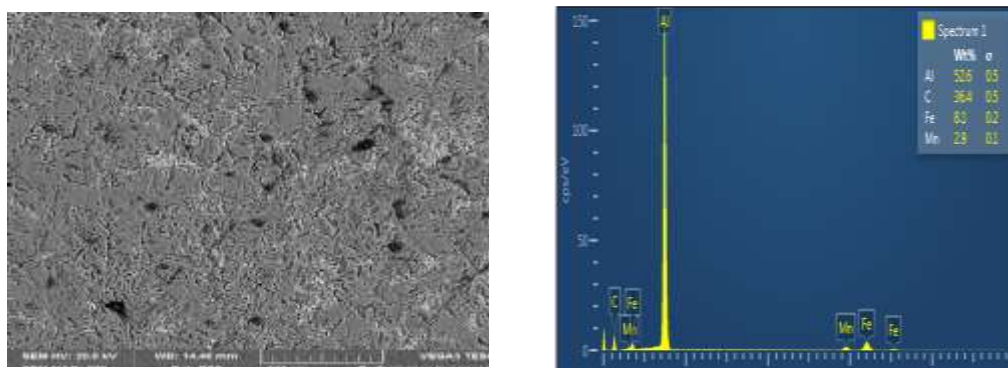


Figure 9: SEM and EDS of Al+2wt. % PWS composite

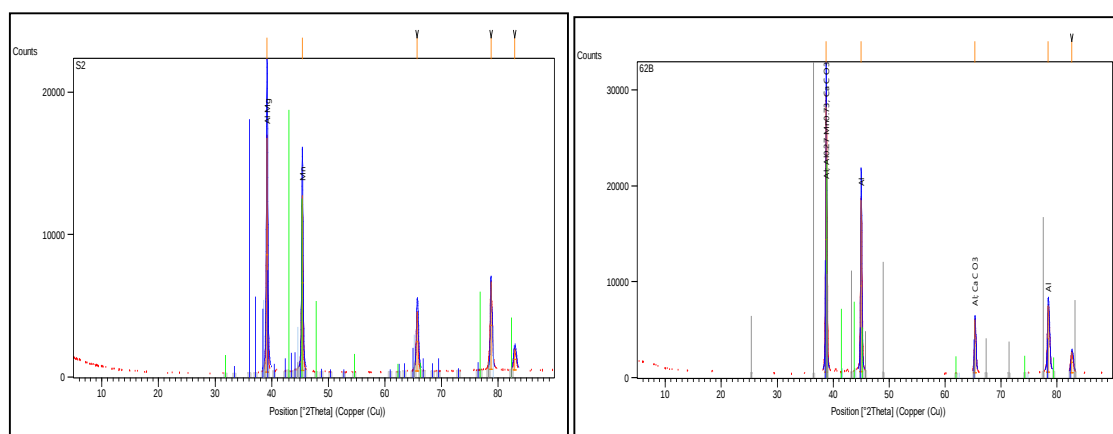


Figure 10: XRD (a)Control sample (b) Al+2%PWS composite

Table 2: Phase Identities of Control sample and 2%CPWS nanocomposite

Control	Manganese	Mn
	Aluminum	Al
	Aluminum manganese	$Al_{0.27}Mn_{0.7}$
	Aluminium manganese	$AL_{0.27} Mn_{0.7}$
Al+2%CPWS composite	Calcium Carbonate	$CaCO_3$
	Aluminum	Al

Density and tensile properties of AL/PWS

Figure 10 represents the plot of density of the composite against wt. % of PWS particle addition. It is interesting to note that the composite becomes lighter as the PWS particle addition increases. This attribute will help to reduce the weight of the connecting rod and therefore translate to improved fuel efficiency. The result is in line with literature, for every 10% reduction in weight fuel economy increases by 6-8% (Patrick et al., 2008).

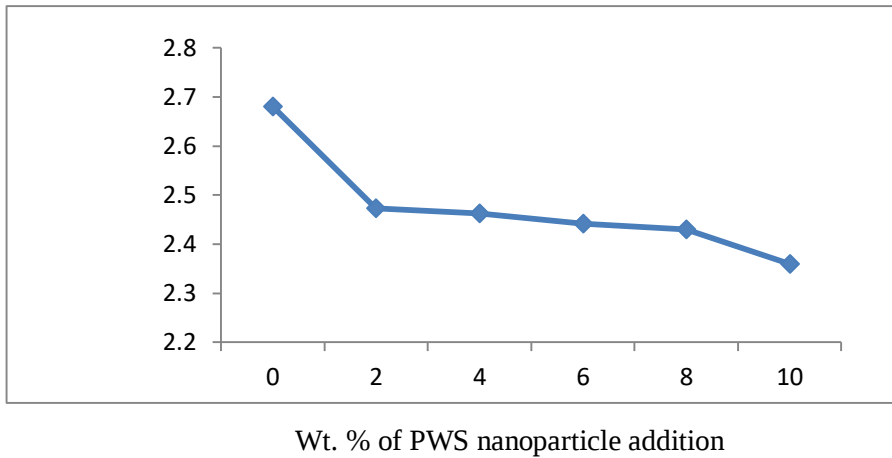


Figure 10: Densities of Al/2wt. % PWS nanocomposite based

One of the most important property requirements of a connecting rod is a material with high tensile property. Figure 11 shows that as the weight percentage addition of PWS particle increases there is corresponding increase in the tensile strength of the composite which is good for the connecting rod.

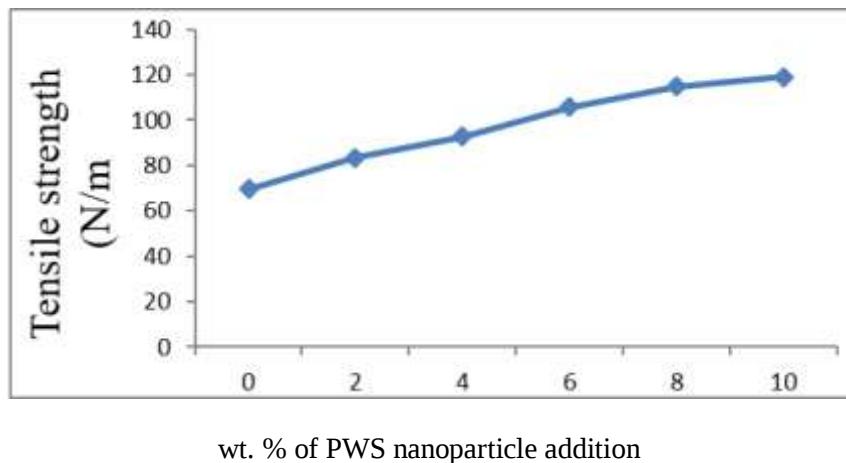


Figure 11: Tensile strength of Al/PWS nanocomposite based connecting rod

Figures 12 and 13 represent the graph of the Tensile strength of Al+2%PWS composite and the Tensile strength of control sample respectively. It can be seen that there is improvement of about

95.45% in the tensile strength of the reinforced composite (see fig12), compared to the unreinforced control sample in figure 13.

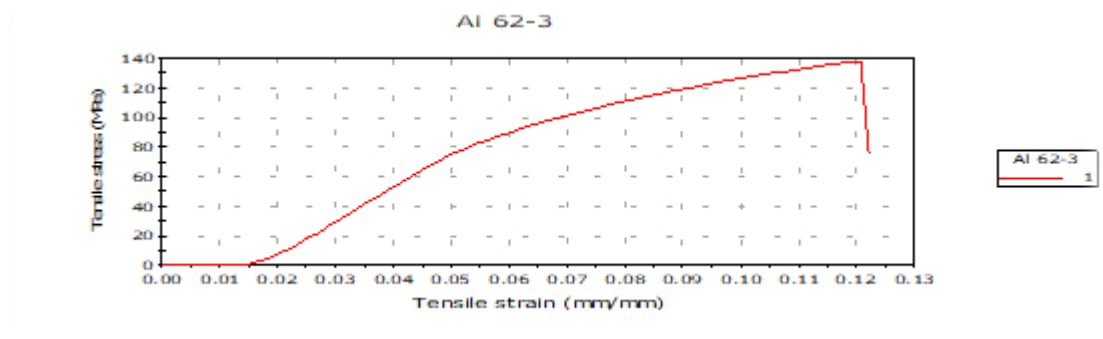


Figure 12: Tensile strength of Al/PWS nanocomposite based connecting rod

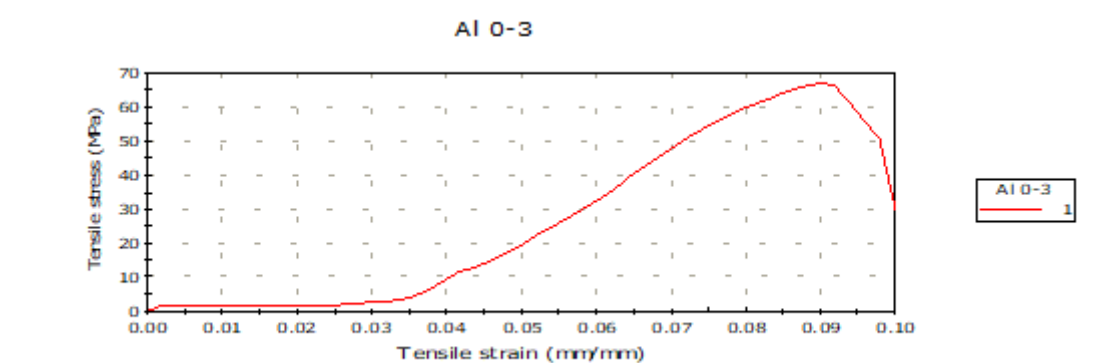


Figure 13: Tensile strength of control sample (unreinforced Al)

Conclusion

From the results of investigation and discussion of this research work, the following inferences can be drawn:

- (1) A cheaper and alternative source of high grade (95.67%) aluminium ingot have been recycled from waste Al Cans with approximately 60% yield.
- (2) New light metal matrix composite suitable for production of tricycle connecting have been produced.
- (3) Incorporation of 39.7nm particulate periwinkle to recycled Aluminium Can has reduced the Density by 12% and improved the tensile properties by 95.45% compared to the control sample.

Even though the research is ongoing, there is substantial evidence based on the results of the tensile properties and microstructure obtained from this work to indicate that the 39.7nm periwinkle shell nanoparticle blended with homogenized Al-Cans is a suitable candidate material for lighter and energy efficient tricycle connecting rod.

Acknowledgement

Authors wish to appreciate the Department of Chemical and Metallurgical Engineering, Tshwane University, Pretoria South Africa for the permission to use their laboratories for the experimentation of this study and Abiye Foundry for the cast sample production

References

- Ajibade, O.A. 2019. Development and Optimization of dual particulate reinforced polymer composite for automobile Brake Pad Application [PhD thesis]. University of Lagos; 2019.
- Benson, A. 2008. Littorina Littorea–USGS Nonindigenous Aquatic Species Database, Gainesville, FL <https://nas.er.usgs.gov/querries/Factsheet.asp>.
- Das, S., Prasad, S.V., and Ramachandran, N. 2008. Synergic Effect of Reinforcement and Heat Treatment on the two Body Abrasive Wear of an Al-SiAlloy under varying Loads and Abrasive Sizes, *Wear*, 64:47-59.
- Douglas, M., Baka, M.K., Salley, E.M. and Paul, H. W. 1986. The Impact of ‘Bottle Bill Legislation on the Incidence of Lacerations in Childhood. *American Journal of Public Health*.
- Jamabo, N. and Chinda, A. 2010. Aspects of the ecology of *tympanotonous fuscatus* var *fuscatus* (Linnaeus, 1758) in the mangrove swamps of the upper Bonny River, Niger Delta, Nigeria. *Current Research Journal of Biological Sciences*, 2(1): 42-47.
- Mmom, P. C. and Arokoya, S. B. 2010. Mangrove Forest Depletion, Biodiversity loss and Traditional Resources Management Practices in the Niger Delta, Nigeria. *Research Journal of Applied Sciences, Engineering and Technology*, 2(1): 28-34.
- Pathade, V.C., Bhumeswar, P. And Ajayi, N.I. (2012). Stress Analysis of I.C. Engine Connecting Rod by FEM. *International Journal of Engineering and Innovative Technology*. Vol.1(3):12–15.
- Patrick, S., Rogelio, C. and Joseph, C. 2008. Progress Report for Light weight in materials. U.S Department of Energy Efficiency and Renewable Energy.
- Priyank, D.T., Ravi, C.T. and Nikhil, J.C. 2013. Design and Finite Element Analysis of Aluminium – 6351 Connecting Rod. *International Journal of Engineering Research and Technology (IJERT)* Vol.2 (5).
- Rino, J.J., Chandramoham, D., Sucitharan, K.S. and Jebin, V.D. 2012. An Overview on Development of Aluminum Metal Matrix Composite with Hybrid Reinforcement. *IJSR India* online ISSN, 2319-7064
- Saheed Ahmed G.M., Sirajuddin, E.K. and Syed, H.S. 2014. Design, Fabrication and Analysis Connecting Rod with Aluminium Alloys and Carbon Fibre. *International Journal of Innovative Research in Science, Engineering and Technology*. Vol.3, Is.10.
- Weil, J.W.V., Besouw, M.V. and Huijbers, S. 2012. Future of Automotive Design and Materials Trends and Developments in Design and Materials. Automatic Technology Centre. Acemr.eu.

BOOK OF ABSTRACTS

CRITICAL INSIGHTS ON AFRICAN TRADITIONAL RELIGIOUS BELIEFS AND PRACTICES WITH REFERENCE TO CHINUA ACHEBE'S *THINGS FALL APART*

***Ndubuisi H. Onyemelukwe and Catherine O. Ogbechie**

Department of Languages, School of Liberal Studies, Yaba College of Technology,
Yaba, Lagos

*ogbechiekate@gmail.com

ABSTRACT

African traditional religious beliefs and practices are the contextual manifests of African traditional religion (ATR). This assertion expresses the fact that ATR is virtually if not precisely as old as Africa and Africans. Why the emphasis on the reality and genealogy of ATR? Europeans, during their colonisation of Africa, falsely created the impressions that Africans are a people with neither culture nor philosophy. Indisputably, these impressions incorporate their equally wrong notion that Africans have no religion. Onyemelukwe and Fatuase (2012) have debunked this fallacy by depicting that the fundamental of African metaphysics is faith in the Supreme God, worshipped by non-Christian Africans through many gods, recognised in their religion as His emissaries. Nevertheless, this study critically focuses on ATR with reference to Chinua Achebe's *Things Fall Apart (TFA)* for the purpose of identifying its merits and demerits with appropriate recommendations for eliminating the latter as captured in the implications of the study. *TFA* is purposively selected for the study for very richly reflecting dramatic episodes which are apt indices of African traditional religious beliefs and practices. Consequently, the analytic interest of the study is focused on the most significant of such episodes for the purpose of critically expounding the traditional religious beliefs and practices unfolded in them, including and especially those embodied in proverbs, anecdotes and other elements of African oral tradition as well as related authorial remarks. An incident is most significant if it embodies positive beliefs and practices strictly native to Africans as represented by the Igbos of Nigeria with or without equivalents in Christianity. Incidents which unfold borrowed or domesticated beliefs and practices rooted in Christianity are also considered most significant. The theoretical basis for the study provides pertinent expository insights on the metaphysical world and morality in ATR. One critical finding of the study is that while ATR, as asserted in both the introductory section and the

theoretical basis for the study, believes in the Supreme God, most of the specific beliefs and practices of its adherents do not support the claim. Consequently, it is recommended in the study that enlightened ATR adherents proceed to radically modernise the religion by means of unreserved reformation, relying on Christianity, Philosophy as an academic discipline and African native wisdom as largely incorporated in African oral tradition.

Key words: African traditional religion, Critical insights, African oral tradition, *Things Fall Apart*

20C/ART/002P

**NIGERIA, GHANA AND UGANDA’S CULTURAL POLICIES’ SPECIFICATIONS
ON MANAGING CULTURE, ARTS AND CREATIVITY TOWARDS SAVING THE
EARTH**

Osedebamen David Oamen

Department of Theatre and Media Arts, Ambrose Alli University, Ekpoma
forthspring@yahoo.com

ABSTRACT

This paper is on Nigeria, Ghana, and Uganda’s cultural policies’ provisions on the management of culture, the arts and creativity towards saving the earth. The aim of the paper is to examine the cultural policies provisions of these countries cultural management towards saving the earth. The paper engages in cultural policies of select African countries with a view to examine their culture, the arts and creativity administration with intent to evaluate their support towards saving the earth. Saving the earth has become so important in contemporary time due to deliberate human effort to recover natural aperture the earth provided for itself for safety sustenance by man for survival. The evaluation of cultural policies at this time in Africa is very important in this regard because there is the need to know if there are specified provisions for saving the earth through culture, arts and creativity management which is a part of human endeavour on earth. It is also important to do this evaluation because the countries in focus are developing and might not see the significance to include specifications that will advance the need to save the earth. The findings of the evaluation shall reveal which of these countries included specification for saving the earth on her cultural policy and the purpose it intended it to serve. This shall signal the importance of

cultural policies specifications for those countries who do not initially anticipate the need. The methodology for the evaluation is comparative qualitative; it shall consult books both in the library and internet. The recommendations shall be drawn from the findings on the usefulness of including specifications in the cultural policy towards saving the earth. It shall conclude on the importance of saving the earth through culture, arts and creativity via the cultural policy.

Key words: Nigeria, Ghana, Uganda, cultural policies, earth

20C/ART/003P

**MEMORIALISATION AND NEW MEDIA: AN ANALYSIS OF THE OHAFIA
HEROIC PRACTICES IN BATTLE OF MUSANGA**

Okolie, G.I.

Department of English, Faculty of Arts, University of Lagos
glo_okolie@yahoo.com

ABSTRACT

The study examines the mediation of the traditional Ohafia war festival and the new media in contemporary Nigerian society. Scholarly works have revealed that the Nigerian pre-colonial societies were regulated by the beliefs, values, norms and customs that defined man's existence. With the dawn of modernism and its appurtenances- industrialisation and commercialisation- the traditional essence that defines man's interaction with his social environment runs the risk of being endangered given prevailing realities that characterise contemporary man and his society. In order to mitigate, on the one hand the deleterious effects of modernisation on traditional practices as well as enhance its functional values on the other hand, Nigerian filmmakers memorialise these traditional practices that define the Nigerian essence through the agency of the Nigerian Video Industry (Nollywood). This study, therefore, employs Carl G. Jung's Collective Unconscious and Roland Barthes' Semiotic Approach to Representation as they examine the representation of the traditional Ohafia heroes in the Nollywood alongside the archetypal thoughts, traits and attitudes that influence the dispositions of the Ohafia warriors. Though scholarly works reveal that the mediation of tradition and the contemporary media form jeopardises the intrinsic oral elements and aesthetics, this study argues that the Nigerian video film remains one of the

veritable media through which traditional experiences are not just recreated but revived.

Keywords: Memorialisation, New Media, Reification, Heroic Culture

20C/ART/004P

EDUCATIONAL THEATRE MANAGEMENT IN NIGERIA: NEW FRONTIERS

Okwulugo, Maureen

Department of Creative Arts, Faculty of Arts, University of Lagos

mrsposh2015@gmail.com; mokwulogu@unilag.edu.ng

ABSTRACT

Education plays a fundamental role in young people's lives. Though approaches to education differ, there are some common goals which is, to give young people the knowledge and skills needed to survive in a global society and to help them grow and develop into scholars. This paper focuses on how the educational theatre management in Nigerian institution is reflected in the professional sector in a bid to understand if there is any relationship between both sectors. The Department of Creative Arts at the University of Lagos is the paradigm of this paper to investigate their teaching method and its affiliation with the profession of the course in order to prevent the students from struggling to adapt when they leave school. It was observed that some methods used in teaching the students which had been a model is not replicated in the profession of the course, this paper therefore recommends areas that vicissitudes in the educational sector and also proposes a practical curriculum thereby creating an affiliation between the educational and professional division as this will help the students be more engaged and take theatre more seriously as well as appreciate it. This paper comprehends that students will be more devoted and passionate about their studies because they are not spending time and money on obscurity but on something attainable.

Keywords: theatre management, educational theatre, professional theatre, theatre curriculum and the Nigeria society

**BETWEEN THE ANTHROPOCENTRIC AND BIOCENTRIC DOCTRINES IN
ENVIRONMENTAL ETHICS: AN ECOLOGICAL EDUCATION AND RESPONSE
FROM “*LAUDATIOSI*”**

^{1*}Irabor, Benson Peter and ²Ani, Moses Igwebuike

¹Department of Philosophy, University of Lagos.

²Dominican University, Ibadan,

*benpet1@yahoo.com; igwy97@gmail.com

ABSTRACT

In recent times, ethics of environment or environmental ethics is experiencing a speedy growth, which is already putting it beyond the class of applied ethics. With the recent discussion of global climate change, environmental ethics is again at the forefront of business and public policy. However, the discourse on the place of the environment, the nature of her values and whether or not these values depend on human whims and caprices is the justification for this research. Usually, scholars are divided between the anthropocentric and biocentric outlooks to the discourse. Granted, both are committed to bringing awareness and quest for sustainable approaches to the tumultuous issues that have greeted nature in recent times, they fall short because of their exaggeration in their discourse on nature and in some cases in their triviality concerning the values of nature. Upon the use of the method of philosophical analysis and interpretation, this research proposes an ecological pedagogy that is theological yet relies on Pope Francis’ encyclical letter “*Laudatiosi*.” From this Encyclical, this research submits that a proper blend or balance between the anthropocentric and biocentric doctrines may be attained from “*Laudatiosi*” without compromising the shortcomings of each of the initial extremes.

Keywords: Anthropocentrism, Biocentrism, Environmental Ethics, Pope Francis, “*Laudatiosi*.”

20C/ART/006P

**THE CULTURE OF DEFACING PUBLIC SPACES WITH ELECTORAL
CAMPAIGN POSTERS DURING ELECTIONEERING IN LAGOS STATE**

Olusoji O. Oshisada

Department of Art and Industrial Design
Lagos State Polytechnic, Ikorodu, Lagos State.
artistsoji80@yahoo.com

ABSTRACT

This paper presents the challenges posed by politicians and party members on the issue of defacing public spaces with electoral campaign posters during electioneering period. Electoral campaign poster is a campaign medium utilised extensively during electioneering in Nigeria. Over the years, the adopted campaign strategy has turned out to be a political culture. Every part of Lagos state is littered with accumulated campaign posters which distort the aesthetic landscape. The aim of the paper is not to antagonise a political party but to identify environmental challenges posed by indecent pasting of electoral campaign materials in public spaces and proffer appropriate measures to curb the situation. What are the proper approaches to campaign publicity to avoid defacing public spaces? What is government's response towards eradicating indiscriminate pasting of campaign posters? Findings reveal that there are laid down guidelines for pasting posters. Related publications and newspaper interviews with management of regulatory agencies were consulted online. The paper enlightens political stakeholders to imbibe the right attitude for the built environment with respect to campaign posters as part of efforts to attain environmental sanity.

Key words: Electioneering, deface, public space, aesthetic, campaign posters

**THE AESTHETIC AND CULTURAL VALUE OF TIKTOK: PRESERVING OUR
MINDS, BEAUTY AND CULTURE**

***Stephen E. Oriaku and Toluwalase M. Alli**

Department of Philosophy and Institute of African and Diaspora Studies
University of Lagos

*soriaku@unilag.edu.ng, allitoluwalase.mazeedat@gmail.com

ABSTRACT

The effects of the COVID-19 pandemic contribute to the immediate significant changes in human history, especially the present reformations on identity, constructs about mental wellbeing, as well as social values. To preserve humanity while saving the earth, a number of individuals have sought various forms of coping mechanisms and entertainment while observing safety measures aimed at preventing the spread of the Corona virus. The mobile application, TikTok, has been the most expressive means for individuals to manage effective issues like prejudice, psychological well-being, police brutality inside the African mainland and elsewhere during the pandemic. As such, the thrust of this paper is concerned with the examination of the social media application, TikTok, as a growing and stable means applied for the preservation of humanity during the pandemic. This paper examines the aesthetic and cultural influences of TikTok while analysing such themes as identity, anti-racism movements, mental wellbeing, and aesthetic values amongst others. Applying the qualitative and hermeneutic methods of research, this paper examines the effectiveness of TikTok, as well as the possible limitations on Millennials and Generation Z individuals during the COVID-19 Pandemic. We conclude that given the common move against the norm, Tiktok serves as part of a process for people to take on responsibilities aimed at speaking against injustice, educating the masses on individuality and diversity, and organising safe ways to reclaim lost values. It reiterates the idea that to manage issues we cannot concretely engage or instantly resolve, we discover comfort in the most agreeable methods for articulation.

Keyword: Tiktok; African; Culture; Aesthetics; African in Diaspora; Mental Wellbeing; COVID-19 Pandemic

**COVID-19 PANDEMIC: THE PLACE OF TEXTILE IN NEUTRALIZING THE
SPREAD OF THE PATHOGENIC VIRUS**

Ajayi O.T. and Seyi-Gbangbayau P.S.

Department of Art and Design, The Federal Polytechnic, Ilaro
Poly Road, Oja-Odan Expressway, Ilaro Ogun State, Nigeria
yemi.wajayi@gmail.com; olayemi.ajayi@federalpolyilaro.edu.ng
paul.seyi-gbangbayau@federalpolyilaro.edu.ng

ABSTRACT

In late 2019, a virus popularly called corona virus otherwise known as COVID-19 sufficed; taking its source from the capital of Hubei Province in China known as Wuhan. The virus turned out to be termed a highly communicable and pathogenic viral infection proposed to be caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). In early 2020, the pathogenic virus, COVID-19, being left unattended to, spread to become a global pandemic disease. Therefore, the need to curtail and contain the viral infection became expedient. Nations globally began diverse measures to curb the spread of the virus that was already claiming lives and melting global economy. The spread of the virus mandated the need for critical measures be put in place to arrest its incessant spread. With the efficiency of certain measures initiated and the gradual victory currently being experienced globally, however the credits cannot be accorded to science and technology; without recourse to the arts. The general belief is that only science and technology played the roles of neutralising the spread of the virus to an assuring level, leaving out the significant roles played by art. This study hereby traces significant roles played by a facet in art, textile, in augmenting science and technology to neutralise the sporadic spread of the pathogenic viral infection. This study maximised the use of literature review, internet resources as well as few of the audiovisual clips and graphic pictures in circulation during the pandemic period. This paper concludes that it was through textile that both the medical and fabric nose covers came into existence having undergone a sewing process which is usually done by artisans in art. The nose covers played significant role having been used as one of the key precautionary measures to curtail the incessant spread of the pathogenic virus.

Keywords: COVID-19, Art, textile, Science, Technology

**THE SHADOW PANDEMIC: THE CORROBORATION OF CATASTROPHIC
HEGEMONIC MASCULINITY IN NIGERIA**

Bukola O. Amodu

Department of Creative Arts, Faculty of Arts,
University of Lagos, Nigeria.
motunray70@gmail.com; bamodu@unilag.edu.ng

ABSTRACT

Local phenomenon becomes global because details of human experiences reveal similarities with peculiarities. This is observable with the COVID-19 pandemic and the resultant shadow pandemic, described as an allusion to rising global levels of sexual and gender based violence against women and girls as a result of COVID-19. Objectification of the female body remains a disturbing reality and with hegemonic masculinity this cannot but produce a catastrophic result in the society like the shadow pandemic at a time when the social life of the society is stretched to limit. There is the need to postulate preventive measures and not just punishment for gender based violence. This paper proposes that both genders be reoriented and engaged complementarily to prevent further disharmony and degeneration in Nigeria. Present reality demands a shift in our gender expectations. Hegemonic masculinity deeply fabricated into our everyday life puts women at destructive disadvantage, especially as this is backed up by culture and religion. The concept of African womanism encourages determination and grit in the African woman to excel in her ways, carrying her community and male counterpart along in her success. Emphasis needs to be laid on the need for positive male engagement as it is observed that there is connection between masculinity, gender inequity and violence against women and children. *Second Class Citizen* by Buchi Emecheta, *Sweet Revenge* by Irene Salami and *Tuti* by Ahmed Yerima will be examined to evaluate typical Nigerian male/female relationships and suggestions will be made on opportunities for possibilities of better results.

Key words: Shadow pandemic, African womanism, masculinity, relationship

COVID-19 IMPACT ON CHINA-AFRICA EDUCATION AND CULTURAL EXCHANGES

Banwo Adetoro Olaniyi

Department of Linguistics, African and Asian Studies,
University of Lagos, Akoka-Lagos, Nigeria
banwotoro@gmail.com

ABSTRACT

China's rise, development and modernisation with an economic global power status have facilitated a lot of investments in Africa. China's investment in Africa goes beyond resources, it is seen in different agendas and programmes such as by inviting African students to this Asian country to learn, imitate, cultivate and imbibe Chinese education and knowledge at firsthand. The outbreak of COVID-19 in Wuhan, China poses a huge threat to the cultural and educational exchanges that exists between China and Africa. Data for this research work were obtained through homogenous purpose sampling and content analysis was used to study this work. Certain factors such as diplomacy, aid, soft-power, skill transfer, acquisition and development were selected for study in this work. It adopts the Social Exchange Theory as the framework to comprehend this study and it ascertains that certain states make calculations in order to gain more benefits with their actions. It argues that Chinese investment in the African educational sector goes beyond any form of sympathy or empathy but it hinges on the platform of certain rewards, value, gains, benefits, human learning, social progress and international co-operation. This work concludes that Chinese investment in African education aims to bolster up bilateral cooperation between the two countries while aiding China's show of its soft power in the continent.

Keywords: Diplomacy, Soft-power, Skill transfer, Acquisition and Development.

20C/ARTS/012P

**THE ROLES OF CREATIVE ARTS IN CURTAILING THE SPREAD OF THE
CORONAVIRUS PANDEMIC IN OYO STATE, NIGERIA**

Akinpelu Emmanuel Bola

Department of Cultural and Creative Arts
Federal College of Education (Special), Oyo
akinpeluemmanuelbo@gmail.com

ABSTRACT

Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus. The virus that causes COVID-19 is mainly transmitted through droplets generated when an infected person coughs, sneezes or exhales. These droplets are too heavy to hang in the air, and quickly fall on floors or surfaces. This paper discusses the roles of creative arts in curtailing the spread of the coronavirus (COVID-19) pandemic in Oyo state. The paper also examined the use of creative measures such as production of music, drama, visual art, live graphic, textiles to produce jingles that work against the spread of coronavirus. It also examines the use of face mask design in various models using fabrics transparent polymer. It was recommended among others that government should support Creative Arts as a discipline by providing loan in form of grants to the artists to produce jingles that communicate the effectiveness of using masks and transparent polymer in the spread of the disease. Philanthropists and organisations should come into the aids of youth and most young artists to develop their potentials by supporting their education or those embarking on various jobs.

Keywords: Origin, Creative art, COVID-19, Combating, Pandemic

20C/BMS/001P

**SMARTPHONE ADDICTION, SELECTED PSYCHOLOGICAL STATUS
AND CLINICAL VARIABLES AMONG UNDERGRADUATES IN A
NIGERIAN POPULATION**

¹*Akodu A.K., ¹Adenekan Y.A. and ² Zibiri R.A.

¹Department of Physiotherapy, College of Medicine, University of Lagos, Nigeria

²Department of Rehabilitation Science, Kaduna Polytechnic, Kaduna, Nigeria
akoduashiyat@gmail.com, aakodu@unilag.edu.ng

ABSTRACT

In this age, it is known that there are many variables that affect musculoskeletal system and psychological well-being of individuals and technological products are one of the most

important variables affecting human psychology. The purpose of this study was to determine the correlation of smart phone addiction, selected psychological status and clinical variables among undergraduates in College of medicine, University of Lagos. A cross sectional survey was conducted among 837 undergraduates (500 females, 337 males). Questionnaires comprising of smart phone addiction scale, depression, stress and anxiety scale, neck pain disability index and shoulder pain disability index were used to collect self-report measures. Assessment of selected anthropometric variables (weight, height, Body mass index (BMI) was done. Pearson correlation coefficient and spearman rho were used to determine correlation between variables at alpha value of $p < 0.05$. The outcome of this study revealed that more than half, 447 (53.40%) of the undergraduates are addicted to smart phone use. Eighty (9.6%) of the participants have severe depression, 155 (18.5%) have severe anxiety while 59 (7%) are severely stressed. It was observed that there was a significant relationship ($p < 0.05$) but a weak correlation between smart phone addiction, psychological status, pain related disability of neck and shoulder, BMI and weight. Smartphone addiction has an influence on the psychological status, selected anthropometric variables and pain related disability of neck and shoulder of the participants in this study.

Key words: Smartphone addiction, psychological, pain, Disability, shoulder, Anthropometric, Undergraduates.

20C/BMS/002P

PREDICTORS OF DEPRESSION AND NUTRITIONAL STATUS AMONG THE ELDERLY IN SELECTED PRIMARY HEALTHCARE CENTERS IN LAGOS

***Akodu B.A., Akinwunmi S.O. and Onajole A.T.**

Department of Community Health and Primary Care, College of Medicine, University of Lagos

*babakodu@mail.com, bakodu@unilag.edu.ng

ABSTRACT

Worldwide, poor nutritional status and depression have been found to be prevalent in the elderly. The clinical implications of depression and malnutrition on the elderly include increased vulnerability to infection, decreased libido, worsening body pains, increased suicidal thought and behaviour. This study aimed to assess the predictors of depression and nutritional status among the elderly attending selected primary healthcare centers in Kosofe Local Government Area in Lagos State. A descriptive cross-sectional study was carried out

among 219 participants aged 60 years and above using structured interviewer-administered questionnaires to assess the Nutritional status (Mini-nutritional Assessment short form) and depression (Geriatric Depression Scale short form) Data analysis was carried out using Epi-info 7.1. Chi-square and ANOVA tests of significance were done for categorical and continuous variables respectively. The level of significance was set at $p < 0.05$. The proportions of the elderly that had normal nutrition, at risk nutrition and malnutrition were 42%, 49.8% and 8.2% respectively. The proportions of the participants that had no depression, mild depression and severe depression were 53%, 36.1% and 10.9% respectively. There was a statistically significant association between sex, education and nutrition. Body Mass Index was statistically significantly associated with family support and occupation ($p < 0.05$). Statistically, depression was significantly associated with nutrition, sex, income, living arrangement, marriage and education. There was statistically significant difference between height, weight, waist-hip circumference and the nutrition ($p < 0.05$). Nutritional status correlated with body mass index, waist-hip circumference while depression was influenced by nutrition, sex, marriage, educational, occupation, income and family support.

Keywords: Depression, nutritional status, quality of life, elderly, primary healthcare

20C/BMS/003P

EFFECTS OF CORE STABILIZATION AND MCKENZIE BACK EXTENSION EXERCISES ON PAIN, DISABILITY AND INSOMNIA IN PATIENTS WITH NON-SPECIFIC CHRONIC LOW BACK PAIN

***Ashiyat Kehinde Akodu and Kolawole Sulaimon Odunfa**

¹Department of Physiotherapy, College of Medicine, University of Lagos

*akoduashiyat@gmail.com, aakodu@unilag.edu.ng

ABSTRACT

This study compared the effects of core stabilisation and Mckenzie back extension exercises on pain, functional disability, insomnia and Quality of Life (QoL) in patients with Non-specific Chronic low back pain (NSCLBP). Forty-one (41) non-specific chronic low back pain patients (16males, 25 females) participated in this study. They were recruited from Lagos University Teaching Hospital, Lagos. Participants were allocated into three groups using computer generated random number sequence. Group 1 received core stabilisation exercises, Group 2 received Mckenzie back extension exercises and Group 3 received

Transcutaneous Electrical Nerve Stimulation (TENS) and back care education which serves as the control group. Pain intensity, functional disability, insomnia and quality of life were assessed using Numerical Pain Rating Scale (NPRS), Oswestry disability questionnaire, Insomnia Severity Index (ISI) and SF-36 Quality of life (Qol) questionnaire respectively at baseline, and end of 4th week post intervention. There was an improvement in the clinical outcome; pain ($p=0.001, 0.004$), functional disability ($p= 0.001, 0.01$) and insomnia ($p= 0.001, 0.012$) in both groups 1 and 2 but most of the improvement was noticed in group 1 post intervention. Significant improvement was displaced in the general health ($p=0.001, 0.004, 0.049$), Physical function ($p=0.001, 0.007, 0.007$) and Social Function ($p=0.026, 0.02, 0.007$) domains of quality of life post intervention in all the 3 groups (1, 2, 3). Across groups comparison showed, significant difference in pain ($p=0.01$), insomnia ($p=0.02$) and physical function ($p=0.002$). The use of core stabilization exercises is clinically more beneficial compared to McKenzie back extension exercise in the improvement of pain, functional disability, insomnia and quality of life in NSCLBP patients.

Keywords: exercises, insomnia, pain, disability, quality of life, patients, chronic low back pain.

20C/BMS/004P

FIRST URGENT SURGERY IN A COVID-19 POSITIVE PATIENT WITH SYMPTOMATIC UTERINE FIBROIDS IN UNIVERSITY OF NIGERIA TEACHING HOSPITAL (UNTH): A CASE REPORT

***^{1,2}Ezenkwele, E.P., ^{1,2}Eze, M.I., ¹Njoku, I.V. and ^{1,2}Obi, S.N.**

¹University of Nigeria, Ituku-Ozalla Campus, Enugu

²University of Nigeria Teaching Hospital, Ituku-Ozalla, Enugu
pezenkwele@gmail.com; ezi.ezenkwele@unn.edu.ng

ABSTRACT

This was the first case of a COVID-19 positive patient that required urgent surgery in a low resource setting at UNTH, Enugu. EA, a 24-year-old nulliparous woman presented with a one-year history of heavy menstrual bleeding. She had a Hb of 3.9g/dl. Ultrasound scan showed a submucosal fibroid. The main diagnosis was symptomatic uterine fibroids causing severe anaemia. Anaemia was corrected by blood transfusion. Several attempts to perform the myomectomy failed for various reasons: doctors' strike action, theatre closed for fumigation

after a COVID case was done, and resumption of menses. Just before surgery, she tested positive for COVID-19, though she was asymptomatic. Due to excessive bleeding at menses that required blood transfusion to correct anaemia, her surgery became urgent. Myomectomy was carried out on 11th July 2020 with the gynaecologists, anaesthesiologists, theatre nurses, technician and porters all dressed in full personal protective equipment (PPE) with infectious disease unit doctors supervising donning and doffing of the PPE. She had an unremarkable post-operative recovery and was also given treatment for COVID-19. With the COVID-19 crisis that is constantly changing and evolving, coupled with the low resource setting in which care took place, the controversy that needs to be settled is the cost-effectiveness of testing before surgery as opposed to not testing and routinely operating with full PPE. In the index case, testing was done prior to surgery. This enabled proper planning towards the surgery and protection of the staff. We would encourage that routine testing for COVID-19 be done for patients undergoing surgery.

Keywords: COVID-19, coronavirus, submucosal fibroid, anaemia, urgent myomectomy

20C/BMS/005P

A STUDY ON THE APPLICATION OF WEB NETWORK AND E-MAIL BASED NOTIFICATION SYSTEM FOR ANIMAL DISEASES OUTBREAKS IN NIGERIA

Oyeleye F.A., Ezenduka E.V. and Ogugua A.J.

Department of Veterinary Public Health and Preventive Medicine, University of Nigeria,
Nsukka

*felix.oyeleye@unn.edu.ng

ABSTRACT

We live in a technology driven society. The information and communication technology (ICT) has continued to sharpen the mode of operation of all facets of human life. Electronic communication is fast becoming an important tool in providing up-to-date and reliable news about threats to humans and animals. The structure for animal disease reporting system in Nigeria is designed and managed exclusively by the government agencies. This structure has been largely ineffective over the years, due to a long chain of command and lack of application of modern communication tools. It is believed that the involvement of nongovernmental organizations would actually bring about an improvement in animal disease

reporting. The aim of this study is to design a website for information dissemination of animal disease outbreak amongst Veterinarians and biomedical researchers across the nation and to create an e-mail disease outbreak notification system through which a preliminary report is promptly sent to all stakeholders in Nigeria. The program is called VetMedmailng.org. A total of 153 initial subscribers were used for this study. Two maiden posts were disseminated via email and the social media within the period of the study i.e. Rabies and African swine fever. The result obtained from an online survey reveals 388 daily views, 153 subscribers and 80% acceptance in less than 5 months. The study has provided insight on the benefits of the use of ICT in promoting quick awareness and prompt dissemination of zoonotic disease outbreaks in animal for public safety.

Keywords: ICT, Zoonoses, notification, outbreaks

20C/BMS/006P

THE EFFECT OF *OCIMUM GRATISSIMUM* LEAF EXTRACT ON REPRODUCTIVE FUNCTIONS IN FEMALE SPRAGUE-DAWLEY RATS

Efua C.A., *Bakare A.A., Okoko I.E., Kusemiju T.O., Samuel T.A., Yama O.E. and Okanlawon A.O.

Department of Anatomy, Faculty of Basic Medical Sciences, College of Medicine, University of Lagos, Nigeria

*aabakare@unilag.edu.ng

ABSTRACT

Infertility is defined as the inability to conceive and maintain pregnancy to full term. It is highest in developing countries due to limited resources for diagnosis and treatment. A large population of the world relies on traditional medicine for treatment of diseases including infertility. *Ocimum gratissimum* (OG) commonly called “Scent leaf” belongs to the group of plants known as spices. Recent studies have shown its efficacy in the reversal of some ovulatory problems. This study is aimed at determining the effects of aqueous and fresh juice extract of OG leaf on reproductive functions. Forty cycling female rats were divided into 8 study groups (A-H). Groups A, B and C received 10 ml/Kg, 7.5 ml/Kg and 5 ml/Kg b.wt of fresh juice extract of OG leaf (FJ EGL) respectively while Groups D, E and F received 200 mg/Kg; 300 mg/Kg and 500 mg/Kg b.wt of aqueous extract of OG leaf (AEGL) respectively based on the LD₅₀ outcome. Group G received 50 mg/Kg of Clomid and group H received distilled water only. Administration was done through the oral route with an oropharyngeal

canula in two divided doses daily for 13 days. The animals were sacrificed on the 14th day by urethane anesthesia. Blood samples were collected by ocular puncture for ELISA hormonal assay. The ovaries were extracted and processed for oxidative stress assay and histological analysis. Animals in the control and OG groups exhibited approximately four days cycling. There were decreased in estrogen and LH levels in Clomid group while both FJGL and AEGL groups revealed significant increase. There were increased superoxide dismutase levels and normal histoarchitectures in the OG groups. Therefore, OG possesses fertility enhancing properties at regulated dosage and may bring positive results on fertility related problems.

Key words: *Ocimum gratissimum*, Reproduction, Estrous cycle, Ovary

20C/BMS/007P

A CROSS-SECTIONAL STUDY ON KNOWLEDGE, ATTITUDE, AND PRACTICES OF VETERINARIANS TOWARDS THE USE OF CEFTRIAXONE IN DOGS IN THREE SENATORIAL ZONES OF ENUGU STATE, NIGERIA

¹*Eze U.U., ²Eke I.G., ²Anaga A.O., ³Udeani I.J., ⁴Ezenduka E.V., ¹Okoroafor O.N.,
²Onyejekwe O.B., ⁵Agina O.A. and ¹Anene B.M.

¹Department of Veterinary Medicine, Faculty of Veterinary Medicine, University of Nigeria

²Department of Veterinary Physiology and Pharmacology, Faculty of Veterinary Medicine,
University of Nigeria

³University of Nigeria Veterinary Teaching Hospital, University of Nigeria, Nsukka

⁴Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary
Medicine, University of Nigeria

⁵Department of Veterinary Pathology and Microbiology, Faculty of Veterinary Medicine,
University of Nigeria

*ukamakauchenna.eze@unn.edu.ng

ABSTRACT

Ceftriaxone a third generation cephalosporin is one of the important antimicrobials used in human medicine especially in critically ill patients. It is one of the drugs of last resort because of its stronger activity against penicillinase producing enterobacteriaceae. As an important antibiotic for humans, ceftriaxone is not meant be used in non-humans. However, it is permitted to be used as extra-label drug in dogs and cats. In Nigeria, laws guiding the use of antibiotic in animals are not strictly enforced, and thus leading to improper and indiscriminate use of antibiotics in food animals which fuels the increase in drug resistant bacteria in the

country. The indiscriminate use of ceftriaxone in animals could be the source of increase in ceftriaxone- resistant bacteria seen in man. The aim of this study was to evaluate the knowledge, attitude, and practices of veterinarians towards the use of ceftriaxone in dogs in the three senatorial zones of Enugu State, Nigeria. A cross sectional survey was conducted using validated structured questionnaire. Eighty (98%) out of 82 veterinarians who participated in this study returned their completed questionnaire. Recurrence of bacterial infection after treatment significantly [$\chi^2 (2) = 24.36 (p < 0.01)$] increased with lower brand price of ceftriaxone used by Veterinarians. The occurrence of side effect also showed a strong correlation ($r = 0.9597$; $p < 0.01$) with increased dose of ceftriaxone administered. Out of the 26 and 57 respondents who admitted to have had the knowledge that ceftriaxone is an extra- label drug used in dogs and one of the drugs of last resort, 3 (11.5%) and 11(19.3%) applied culture and sensitivity tests before its use, respectively. This study has shown that there is a public health threat as indiscriminate use of ceftriaxone in dogs may be responsible for the increase in ceftriaxone- resistant bacteria seen as recurrence of infection after treatment.

Keywords: Ceftriaxone, Veterinarians, Domestic dogs, Cross-sectional survey.

20C/BMS/008P

MORPHOLOGICAL EVALUATION OF THE ORBIT OF THE AFRICAN GRASSCUTTER (*THRYONOMYS SWINDERIANUS*)

***Iheanyi K. Peter-Ajuzie, Innocent C. Nwaogu, Clifford N. Abiaezute and Wilfred I. Ugwuoke**

Department of Veterinary Anatomy, Faculty of Veterinary Medicine, University of Nigeria, Nigeria

* iheanyi.peter-ajuzie@unn.edu.ng

ABSTRACT

The African grasscutter, *Thryonomys swinderianus*, is a herbivorous rodent whose meat is sought after in most parts of western and southern Africa. This has resulted in its domestication and the search for the knowledge of its peculiar biology. This study thus investigated the morphological characteristics of its orbits using descriptive and morphometric gross anatomical techniques. The orbits had complete bony orbital rim and were located laterally within the skull. The orbital volume and orbital axis angle were $2.02 \pm$

0.94 cm³ and 101.15 ± 6.71° respectively while the orbital diameter and orbital depth were 1.87 ± 0.16 cm and 1.84 ± 0.15 cm respectively. At the rostral aspect of the orbit was a large opening, the infraorbital foramen. The laterally situated orbits with their high orbital axis angles are features associated with monocular orbital configuration and panoramic field of vision commonly seen in prey animals. Such features would aid the grasscutter in the wild in the prompt detection of predators and edible plant materials. The enlarged infraorbital foramen is associated with hystricomorphy which is known to improve the chewing efficiency of the rodent due to the passage of the masseter muscle through the foramen. This study has therefore shown that the morphological configuration of the orbit of African grasscutter bestows on the animal a panoramic field of vision and an improved masticatory ability. It also provided morphometric data that will be useful in the identification of orbital pathology in the species.

Keywords: African grasscutter, *Thryonomys swinderianus*, orbit, hystricomorphy, panoramic vision

20C/BMS/009P

A PERSPECTIVE ON NIGERIA'S PREPAREDNESS, RESPONSE AND CHALLENGES TO MITIGATING THE SPREAD OF COVID-19

^{1,2*}Madubuike Umunna Anyanwu, ^{2,3,4}Ishmael Jaja Festus, ⁵Obichukwu Chisom Nwobi, ^{2,6}Chinwe-Juliana Iwu Jaja and ³James Wabwire Oguttu

¹ Microbiology unit, Department of Veterinary Pathology and Microbiology, University of Nigeria, Nsukka 400001, Nigeria

² Risk and Vulnerability Science Centre, University of Fort Hare, Alice 5700, South Africa

³ Department of Livestock and Pasture Science, University of Fort Hare, Alice 5700, South Africa

⁴ Department of Agriculture and Animal Health, University of South Africa, Roodepoort Johannesburg 1710, South Africa

⁵ Department of Veterinary Public Health and Preventive Medicine, University of Nigeria, Nsukka 400001, Nigeria

⁶ Department of Nursing and Midwifery, Faculty of Medicine and Health Sciences, Stellenbosch University, Cape Town 7505, South Africa

* madubuike.anyanwu@unn.edu.ng

ABSTRACT

COVID-19 is a novel disease pandemic that emerged in late 2019 in China, and later spread to other parts of the world, including Nigeria. This review analyses the preparedness of Nigeria to the COVID-19 pandemic and recommends strategies that could be useful in

controlling the disease. Published articles on COVID-19 worldwide, socioeconomic and disease status and preparedness to COVID-19 in Africa and Nigeria, were retrieved from databases such as Pubmed, MEDLINE, Scopus, Web of Knowledge and Google search engine. Nigeria is the most populous black nation in the world, and is one of the largest crude oil producers in the world. However, its healthcare system is dilapidated and weak, due to years of neglect and widespread corruption. As a result, Nigeria is vulnerable to COVID-19, as evidenced by the current geographical distribution of the disease in its population. Many socioeconomic factors could potentially facilitate the spread of COVID-19 in Nigeria. This could lead to a high caseload in the country, which could overwhelm the health care system. The application of social distancing, personal hygiene, especially hand hygiene and mask-wearing, as practiced in many countries, has proven to be effective to reduce the spread of COVID-19. In Nigeria, social distancing, in many instances, may be impracticable, given its large population, and a high density of people living in crowded conditions like slums and camps. Moreover, there is a sizeable population of internally displaced people, due to the attack by Boko Haram fighters in Northern Nigeria, and herdsmen in Southern Nigeria. Nigeria has recorded 46,577 COVID-19 cases among 319,851 persons from its 36 States, giving an infection rate of 14.6% with average of 245 persons infected daily. Nigeria was not well prepared for the COVID-19 outbreak as at the time when the first case was recorded, and thus the response was inadequate.

Keywords: SARS-CoV-2; Boko Haram; health care systems; pandemic; social distancing

20C/BMS/010P

OCCURRENCE OF VAGINAL INFECTION (VOLVOVAGINITIS) AMONG FEMALE TERTIARY STUDENTS IN OGUN STATE

Oladunjoye Z.M., Quadri J.A. and Ojure M.A.

Ogun State College of Health Technology, Ilese- Ijebu.
olaquadri2004@yahoo.co.uk

ABSTRACT

Volvovaginitis is an inflammation of the vagina that can result in discharge, itching and pain. This study determined the occurrence of volvovaginitis among female students in Ogun State College of Health Technology, Ilese-ijebu. A validated questionnaire was used to obtain

information on socio-demographic characteristics of fifty selected students and sterile swab stick was used to collect their vaginal swabs. MacConkey and Chocolate agar were used to culture the microorganisms and data were analyzed using frequency counts, percentages, correlation, and Chi-Square. The result showed that majority of the students were in the age range of 21-25yrs and the hygienic practices of the students were poor because majority do not have access to clean water, about 45% spread their underwear in untidy environment after washing, 27% of them used any material (clothe, tissue paper, cotton wool) during their menstrual period if they could not afford sanitary pad at that moment and 15% confessed that they can wear their pants for two or three days. The isolated micro-organisms showed the growth of *Candida spp*, *Staphylococcus aureus*, *Klebsiella* and *Escherichia coli* in 40%, 22% and 2% of the female students respectively. Chi-square showed a significant association between age and *Candida spp* ($p=0.012$), and *Escherichia coli* ($p=0.004$) while correlation shows a significant relationship between hygienic practices and identified micro-organisms because unclean water was related to *Klebsiella* ($p= 0.311$) while dirty underwear have a significant relationship with *S. aureus* ($p= 0.121$). Conclusively, this study shows the prevalence of vaginal infections amongst female students in the college and could provide important epidemiological data on vaginal infection for future population-based studies.

Keywords: Volvovaginitis, swab stick, MacConkey agar, *Escherichia coli*

20C/BMS/013P

TRENDS AND PREDICTORS OF IN-HOSPITAL MORTALITY AMONG BABIES WITH HYPOXIC ISCHAEMIC ENCEPHALOPATHY AT A TERTIARY HOSPITAL IN NIGERIA: A RETROSPECTIVE COHORT STUDY

^{1,2*}Beatrice Ezenwa, ^{3,4}Gbenga Olorunfemi, ^{1,2}Iretiola Fajolu, ²Toyin Adeniyi, ²Khadijah Oleolo-Ayodeji, ²Blessing Kene-Udemezue, ³Joseph Olamijulo and ^{1,2}Chinyere Ezeaka

¹ Neonatology unit, Department of Paediatrics, College of Medicine University of Lagos, Lagos, Nigeria

² Department of Paediatrics, Lagos University Teaching Hospital, Lagos, Nigeria

³ Department of Obstetrics & Gynecology, Lagos University Teaching Hospital, Lagos, Nigeria

⁴Division of Epidemiology and Biostatistics, School of Public Health, University of Witwatersrand, Johannesburg, South Africa

*beatriceezenwa@yahoo.com

ABSTRACT

Globally, approximately 9 million neonates develop perinatal asphyxia annually of which about 1.2 million die. Majority of the morbidity and mortality occur in low and middle-income countries. However, little is known about the current trend in incidence, and the factors affecting mortality from Hypoxic Ischaemic Encephalopathy (HIE), in Nigeria. We assessed the trends in incidence and fatality rates and evaluated the predictors of mortality among babies with HIE over a five-year period. A temporal trend analysis and retrospective cohort study of asphyxiated babies admitted to the neonatal unit of a Nigerian Teaching Hospital was conducted. The socio-demographic and clinical characteristics of the babies and their mothers were extracted from the neonatal unit records. Kaplan-Meier plots and Multivariable Cox proportional hazard ratio were used to evaluate the survival experienced using Stata version 16 (StataCorp USA) statistical software. The median age of the newborns at admission was 26.5 (10 – 53.5) hours and the male to female ratio was 2.1:1. Nearly half (48.1%) were admitted within 24 hours of life and majority (84%) of the infants were out-born. The prevalence and fatality rate of HIE was 7.1% and 25.3% respectively. The annual incidence declined by 1.4% per annum while the annual fatality rate increased by 10.3% per annum from 2015 to 2019. About 14.1% died within 24 hours of admission. The hazard of death was related to the severity of asphyxia ($p=0.002$), antenatal booking status of the mother ($p=0.01$) and place of delivery ($p=0.036$). The case fatality rate of HIE is high and increasing. Four-fifth of HIE admissions were outborn and the hazard of death was four-fold higher among the outborn. Community level interventions including skilled birth attendants at delivery, newborn resuscitation trainings for healthcare personnel and capacity building for specialized care should be intensified to reduce the incidence, morbidity and mortality from perinatal asphyxia.

Keywords: Trends, Hypoxic Ischaemic Encephalopathy, neonates, Mortality, Nigeria

**PROTECTIVE EFFECT OF EUGENOL EXTRACT ON CARBON
TETRACHLORIDE INDUCED INFERTILITY IN MALE WISTAR RATS**

Mayaki S.O.* , Okoko I.E. and Okanlawon A.O.

Department of Anatomy, College of Medicine, University of Lagos.

P.M.B. 12003, Idi-araba, Lagos State, Nigeria

* yakisam10@yahoo.com

ABSTRACT

Infertility has been reported to be a major problem in all countries of the world. Researches over the years have focused more on understanding causes of female infertility and measures of improving fertility through the use of extracts from medicinal plants. Recently, male infertility has been discovered to account for about 30-40% of infertility cases. Locally, over 20% of Nigerians are also battling with infertility. Studies have reported the medicinal importance of eugenol, the aim of this study therefore was to investigate the protective effect of eugenol on carbon tetrachloride (CCl₄) induced-testicular damages, hence its role in improving male fertility. Thirty-five (35) male Wistar rats were randomly divided into seven groups (n = 5), group I received distilled water, group II (EUG150) received 150mg/kg bw eugenol, group III –V received CCl₄ and 75mg (E75), 150mg (E150) and 300mg/kg bw (E300) eugenol respectively, group VI (CCl₄) received CCl₄ only and group VII (+ve) received CCl₄ and vitamin E. Food and water were provided *ad libitum* to all. There was a statistically significant decrease in testicular superoxide dismutase (SOD) activities of E75 and CCl₄ treated groups compared to the control group. However, E300, E150 and vitamin E-treated groups showed no significant difference in SOD activities compared to control groups. Testicular cyto-architecture of eugenol-treated groups revealed varying degrees of pathological changes as a result of damages induced by the use of CCl₄. The E75 group revealed the most severe damages resulting from different pathological changes, indicating that the effect of eugenol is dose dependent. Findings from this study conclude that the use of CCl₄ induces testicular structure damages and depletion of testosterone levels. Conversely, the use of eugenol played an important role in ameliorating CCl₄-induced toxicity via improving antioxidant functions, preservation of cellular structures and enhancing testosterone levels, similar to mechanism adopted by Vitamin E.

Keywords: Eugenol, carbon tetrachloride, male infertility, testicular damage

THE INFLUENCE OF INTRANASAL *PESTE DES PETITS RUMINANTS* VACCINE APPLICATION METHODS ON THE INDUCTION OF IMMUNE RESPONSES IN GOATS: CLINICOPATHOLOGICAL AND IMMUNOHISTOCHEMICAL FINDINGS

¹Ezeasor C.K., ²Emikpe B.O., ¹Shoyinka S.V.O., ³Udeani I.J., ¹Ezeh N.K. and ⁴Bodjo C.S.

¹Department of Veterinary Pathology and Microbiology, University of Nigeria, Nsukka.
Enugu State, Nigeria.

²Department of Veterinary Pathology, University of Ibadan, Ibadan, Oyo State, Nigeria.

³Clinical Pathology Laboratory, Faculty of Veterinary Medicine Teaching Hospital,
University of Nigeria, Nsukka, Enugu State, Nigeria.

⁴African Union Pan-African Veterinary Vaccine Centre, Debre-Zeit, Ethiopia.
chukwunonso.ezeasor@unn.edu.ng

ABSTRACT

Intranasal administration of *Peste des petits ruminants* (PPR) vaccine has been experimentally demonstrated to have potential for induction of mucosal and systemic immune responses in goats. However, little is known about the influence of intranasal PPR vaccination application methods on the induction of immune response in goats. This study compares the influence of two intranasal vaccine application methods on the immune responses in goats. Twenty male immunologically naive West African Dwarf goats were divided into four groups (n=5). Group A and B were vaccinated intranasally (IN) with live attenuated PPR vaccine (Nigeria 75/1) by either dropper (Group A) or spray (Group B) method and compared with the subcutaneous vaccination (Group C) and unvaccinated control (Group D) for 28 days. H-based PPR blocking ELISA demonstrated high-titres of PPRV-specific antibodies in all vaccinated animals regardless of vaccination route with peak mean percentage inhibitions of 79.3%; 69.8% and 86.6% for IN-Drop; IN-Spray and Subcutaneous vaccination groups, respectively. Pulmonary histomorphological assessment showed the development of bronchus-associated lymphoid tissues (BALT) with PPRV antigens in the lymphoid cells of the germinal centers, detected by PPRV Immunohistochemistry in the IN-Spray group. PPRV antigen was also detected in the spleen and mediastinal lymph nodes of all vaccinated animals after 28 days post-vaccination. The findings of this study show that the choice of application methods for intranasal PPR vaccine delivery is essential in the induction of immune response and the IN-Spray method holds greater potential for pulmonary

protection against the pneumonic form of the disease.

Keywords: *Peste des petit ruminants*, Intranasal vaccination, Immunohistochemistry, Histomorphology, Bronchus associated lymphoid tissues.

20C/BMS/016P

CHEMOTHERAPY-INDUCED OVARIAN TOXICITY IN FEMALE CANCER PATIENTS FROM SELECTED NIGERIAN TERTIARY HEALTH CARE

Samuel T.A.*, Obadipe J.A., Akinlalu A.O., Ajisafe A.O., Olajide E.P., Albdulmumin L.

Department of Biochemistry, Faculty of Basic Medical Sciences, College of Medicine,
University of Lagos

*honeysimpsop@yahoo.com

ABSTRACT

Preservation of Ovarian function and fertility has become one of the major quality of life issues for patients of reproductive age undergoing chemotherapy. Thus, evaluation of ovarian reserve before and after chemotherapy is important for predicting ovarian function of the patients. The study investigated ovarian toxicity of chemotherapy in Female cancer patients in selected Nigerian tertiary hospitals. 160 Participants comprised of 100 radiotherapy naive female cancer patients of age range 18 to 72 years and 60 age-matched cancer free volunteers (control) were randomly selected from three medical centers in south-west Nigeria. Three milliliters of blood samples was collected intravenously from the cancer subjects before chemotherapy and a week after chemotherapy. The collected blood samples were centrifuged to obtain serum. Anti-Müllerian Hormone (AMH) and inhibin-B hormone levels in the sera were quantified by Enzyme Linked Immunosorbent Assay (ELISA). Tukey's One way Analysis of variance was employed to test for the significance difference, with significant level considered at $P < 0.05$. Findings of the study revealed significant decrease ($P < 0.05$) in AMH and Inhibin-B levels in the participants before and after chemotherapy as compared to that of control. In the same way, there was a significant decrease ($P < 0.05$) in post chemotherapy AMH levels as compared that of Pre-chemotherapy. Moreover, a non-significant decrease ($P < 0.05$) in pre-chemotherapy Inhibin-B levels as compared to that of post-chemotherapy was observed. Ovarian reserve suppression observed after chemotherapy in the cancer patients confirmed ovarian toxicity induced by chemotherapy.

Keywords: Anti-mullerian; Inhibin-B; Hormone; Chemotherapy; Enzyme Linked

Immunosorbent assay

20C/EDU/001P

THINKING SAFE EARTH: THINK INTEGRATED RELIGIOUS EDUCATION

Abbas Aremu Rahman

University of Lagos, Lagos, Nigeria

Department of Arts and Social Sciences Education

arahman@unilag.edu.ng

ABSTRACT

Our earth remains quintessential and enigma. So, it must be treated and developed as such to remain safe for the inhabitants. This is a culture that must be transmitted through the instrumentality of integrated educational system. Such a school system will be both vertically and horizontally structured with the flavour of religious ethics. This natural ethics from the world of nature would be infused into every other educational programme for the recipients to appreciate the nature of the earth, its relevance to their lives and be ready to nurture it naturally for all. In this way, the earth will become safer for us all in the nearest future as this is the only abode for humans; both the living and the dead. Accordingly, the objectives of this paper are to: expose educational policy maker, the pivot stake holder of the sector, to the concept of Islamic Integrated Educational System (IIES); Its curriculum structure and component; the implementation Model(s); and its efficacy for the intended sustainability. To achieve these objectives, Case Study design and analysis is adopted. It is, therefore, recommended, among others, that: government should institutionalise the IIES; or as a matter of urgency, teachers, the key players at the implementation level, to adopt the Integrated Teaching Approach (ITA) which could be applied independent of the government policy.

Keywords: Islamic Integrated Educational System; Integrated Curriculum; Integrated Teaching Approach

**IMPACT OF COVID-19 LOCKDOWN ON MARITAL WELLBEING AMONG
MARRIED PERSONS IN ETI-OSA LOCAL GOVERNMENT AREA OF LAGOS
STATE**

Anyama S.C.

Department of Educational Foundations, University of Lagos, Akoka
sanyama@unilag.edu.ng

ABSTRACT

The COVID-19 lockdown imposed by the Federal and State Governments across the country especially in Lagos State to curtail the spread of COVID-19 affected marital wellbeing. The lockdown and restrictions forced couples to stay together irrespective of their marital challenges. The study examined the impact of COVID-19 lockdown on marital wellbeing among married persons. Three research hypotheses guided the study. The study was limited to married persons in Eti-Osa Local Government Area of Lagos State. Eti-Osa Local Government Area was chosen for the study because it is one of the local governments with the highest numbers of cases recorded in Lagos State. Descriptive survey research design was used in the study. Seventy-five (75) married persons were sampled using stratified sampling technique (39 women and 36 men). A 25-item modified Index of Marital Satisfaction (IMS) was used for data collection. The questionnaire has a reliability coefficient of 0.87. The data collected were analysed using one-way and two-way Analysis of Variance (ANOVA) statistical tools at 0.05 level of significance. The results of the analyses showed that there is a significant impact of COVID-19 lockdown on marital wellbeing. Secondly, length of marriage during COVID-19 lockdown significantly influenced marital wellbeing. Finally, there is a significant gender impact of COVID-19 lockdown on marital wellbeing with the men significantly manifesting negative mental health than women due to COVID-19 lockdown. These findings were exhaustively discussed and their implications for counselling were equally discussed. Based on these findings, the study recommends systematic counselling for married persons on the need for and impact of creating and spending quality time with the family, irrespective of their busy schedules.

Keywords: COVID-19, Lockdown, marital wellbeing, married persons

ACCESSIBILITY AND USABILITY OF TECHNOLOGY IN EDUCATION

Bello S.A., Okenwa P.C. and Akpotoma A.A.

Department of Educational Management, University of Lagos, Akoka, Lagos
dr_sabello@yahoo.com; okenwapatience@gmail.com; akpoade@gmail.com

ABSTRACT

This research examined the accessibility and usability of technology in education in Lagos State. Descriptive research design was adopted for the study. A total of 224 participants were selected from six public and six private schools within education district IV of Lagos State using stratified and simple random sampling method. The research instrument used was a three and four point modified Likert Rating Scale Questionnaire type. Descriptive statistics of frequency counts was used to analyse the data, percentage, mean and standard deviation were used to answer the research questions. The hypotheses formulated were tested using the Pearson Product Moment Correlation, independent t-test and Regression Statistical tools at 0.05 level of significance. The result from the findings showed that accessibility and usability of technology in education has significant relationship with effective teaching and learning in Lagos state secondary schools; there was a significant difference in the use of educational technology tools for teaching between public and private schools in Lagos state secondary schools. They recommended that government and other education stakeholders should respond positively and provide enough ICT infrastructures in all the secondary schools across the state so as to encourage teachers to utilize these ICT infrastructures in their teaching. Also the provision of teacher training programmes and skill development which will encourage teachers to have the requisite skills, competence and exposure to enable them be more proficient in the utilization of ICTs in teaching/learning activities. This study concluded that there was positive relationship between availability, accessibility and usage of educational technology and effective teaching and learning in Lagos State. Also, there was a significant difference in the usage of educational technology tools for teaching between public school and private school in Lagos State.

Key words: Accessibility, Usability, Technology, Education

**COVID-19 LOCKDOWN: A CATALYST FOR GLOBAL VIRTUAL LEARNING
ACTIVITIES AND DISTANCE EDUCATION STRATEGIES FOR SUSTAINABLE
DEVELOPMENT**

Motunrayo A. Adeosun

Department of Adult Education, University of Lagos, Akoka-Yaba
mogunfowora@unilag.edu.ng

ABSTRACT

Globally, the world is faced with the COVID-19 pandemic which has held the economy at ransom not exempting the educational sector. It has induced increased incidence of online studying and unemployment because of urban lockdown, occasioning emotional trauma on families and individuals. Educational sector globally is seen to be shifting towards e-learning in order to cushion the effect of this pandemic. In Nigeria, the COVID-19 incidence varies by state, therefore compelling different public health measures and placing varying levels of demand on state apparatus. The aim of this study is to explore and describe distance education strategies to ameliorate the spread and effect of the pandemic on education sector. The paper began by exploring Distance education and E-learning for the purpose of improving adult learning through distance education in the 21st century. The findings show that the process of shifting learning from traditional way to online format has come to stay. Due to isolation, the use of technology has been considered the appropriate alternative to keep educational systems functional in many parts of the world during this period. Despite the challenges in implementation, several advantages have been acknowledged in the need to shift to online learning, among which stands out the opportunity for rapid progress in the field of digital education (Lurvnik 2020). It is recommended that families should learn how to use technology and various e-learning platforms in order to cope with the current educational situation and view the overall schoolwork transferred to homes as useful learning.

Keyword: Catalyst, Virtual learning, Distance, Education and Strategies

**FIRST PRINCIPLES THINKING APPROACH TO GRADUATE UNEMPLOYMENT
AND EMPLOYABILITY IN NIGERIA**

Olabiyi O.B.

Department of Educational Foundations,
University of Lagos, Lagos Nigeria.
oluwatosinbabatomiwa@gmail.com

ABSTRACT

First principles thinking involves an assumption used to explain complicated problems and to unleash creative possibilities. It was described by Aristotle as a process of finding solutions by way of reverse-engineering of societal challenges. The Nigerian society has been faced with the menace of unemployment over the years; however, this was not the case when Higher Education was introduced to the Nigerian society. The society at that time began to adapt education as a tool for social change and social mobility as education paved way for people to become actively involved with the economy thereby getting an opportunity to work either as Government staff or with private organisations and in return for their contribution to the economy they earned wages and salaries to which their families could also benefit from. It could however be said that at that point in time the Nigerian society benefited immensely from Higher Education which gave room for peace and tranquility to thrive. Nonetheless, as of today the society is faced with the challenge of unemployment and it has become a concern not just because unemployment has ravaged the Nigerian society but because University graduates have been mostly affected by this menace. This article hence examines graduate unemployment and employability in Nigeria and recommends that work study program be incorporated into higher education system, organisations should be encouraged to employ fresh graduates as part of their corporate social responsibility and that NYSC should be incorporated with the National Directorate of Employment (NDE) as an employment route for graduates in order to help recreate the peace and tranquility we once enjoyed.

Keywords: First Principles Thinking, Graduate, Unemployment, Employability, Nigeria

**APPLICATION OF STATISTICAL TECHNIQUES IN THE DETERMINATION OF
INFLUENCE OF OFFICE ENVIRONMENT ON TEACHERS PRODUCTIVITY**

**^{1*}Odumosu Oluwakemi Omolara, ²Odumosu Odugbemi Olawale, ¹Odumosu-oduwole
Taiwo and ³Banjoko Oluwole Adebayo**

¹Department of Computer Science, Ogun State College of Health technology, Ilese-Ijebu

²Department of Chemical Sciences, Tai Solarin University of Education, Ijagun, Ijebu-Ode.

³Department of Medical Imaging Processing Technician,

Ogun State College of Health Technology, Ilese-Ijebu

*seunbabaralayemi2016@gmail.com

ABSTRACT

Teachers' offices are administrative functional unit of every department that should allow adequate time to attend to students and various academic works. Unfortunately, few hours are seen conveniently dedicated to attend to these academic necessities by the teacher. The goal of this research is to investigate the relationship between office environment and productivity, job motivation, punctuality to lectures, and time spent in office by an academic. A structured, self-developed questionnaire which was validated by experts in the field and was also subjected to statistical rigor thereby producing an Alpha reliability co-efficient of .68 was administered to 70 respondents of all cadres of Academic staff of Tai Solarin University of Education, Ijagun. A descriptive analysis of the survey with convenient sampling methods (ANOVA) was used for the study. Findings showed a significant relationship between office environment and job motivation only ($p = 0.006$), whereas there is no significant relationship between: office environment and productivity, office environment and punctuality to lectures, and likewise, office amenities to number of hours spent in the office with p values of 0.299, 0.417, and 0.176 respectively. The study however showed concordance with the work of Haynes, (2008) as there may actually be no clear agreement as to how office comfort should be measured.

Keywords: Office-Environment, Productivity, Teacher, Punctuality, Office-Amenities

**BEHAVIOURAL PATTERN ADJUSTMENT IN THE WORKPLACE AMIDST
COVID-19 PANDEMIC**

Odusanya Anike T.

Department of Adult Education, University of Lagos
odusanike@gmail.com

ABSTRACT

Behavioural pattern adjustment in the workplace amidst COVID-19 pandemic is a research effort geared towards reducing and if possible, eliminating the fears that the pandemic has created in workers in different discipline. The number of cases keeps increasing which necessitated this study to find out if the behavioural pattern of workers in the workplace is a contributing factor influencing number of casualties recorded daily. The study adopted qualitative research of phenomenological design and uses interview to generate data, population of the study comprise of workers in the formal sector. Purposive sampling was used to select ten respondents across various professions. Conclusively, Responses from the study show that few find it easy adjusting to the behavioural pattern in their various workplace because colleagues and customers are supportive however, majority of the responses indicate that there is difficulty adjusting for some reasons, one of which is that employer gives targets to be met which they are unable to meet up because of time slated by the government for work hours. This then implies a reduction in paychecks which is a blow due to the challenging moment resulting from COVID-19 pandemic. When this occurs, coordination of workers to be sensitive to safety guidelines is reduced which in a way has an influence on the rise in the number of cases. The study recommends that government should subsidize VAT, bills, transportation and similar others as this will assure everyone of not being alone in the fight against COVID-19 thereby increasing the thrust of behavioural pattern adjustment during this pandemic.

Key words: Behavioural pattern, Covid-19, Workplace, Adjustment.

A HYBRID-BASED GENETIC ALGORITHM FUZZY LOGIC (GAFL) DECISION SUPPORT SYSTEM FOR NURSE SCHEDULING PROBLEM

¹Odumosu Oluwakemi Omolara, ²Oladosu John B., ³Odumosu Odugbemi Olawale,
⁴Oladunjoye Zenab Mosunmola

¹Department of Computer Science, Ogun State College of Health Technology, Ilese-Ijebu

²Department of Computer Science, Ladoke Akintola University of Technology, Ogbomosho

³Department of Chemical Sciences, Tai Solarin University of Education, Ijagun, Ijebu-Ode,

⁴Department of Medical Laboratory Sciences,
Ogun State College of Health Technology, Ilese-Ijebu, Nigeria.

ABSTRACT

Allocation of employees' shift schedule in organisations that runs 24hours service becomes a major problem for the shift designer due to trying to satisfy the employees and satisfy the employer. The task of designing the schedule due to conflicting interest between the hospitals and nurses is very complex and a difficult one to achieve. As a result, algorithms developed to solve the nurse scheduling problem (NSP) are either too slow or they yield unsatisfactory results. Against this background, a Genetic Algorithm Fuzzy Logic (GAFL) Decision Support System (DSS) is proposed to solve the problem. The main objective of this paper is to develop a decision support system using genetic algorithm and fuzzy logic for nurse scheduling. The research design employs a decision support framework combining a genetic algorithm and fuzzy logic approach and applied it to a nurse scheduling problem. The genetic algorithm factors all the hard constraints and some of soft constraints to generate a feasible schedule. Fuzzy logic membership functions are further used to know which nurses' preferences are to be satisfied first based on their ranks and years of service. The system presents an interface to interact with the Decision Support System. The results show that our Decision Support system that integrates the genetic algorithm and fuzzy logic was able to generate a feasible schedule of fitness function of 89.73% in terms of quality and computational time of 164 (sec). This paper has developed an acyclic roster capable of returning feasible solution that satisfies our hard constraints. Our model therefore could equally serve as a partial schedule where the head nurse could make adjustment manually to the roster if the need arises.

Keywords: Genetic Algorithm, Decision Support system, Nurse Scheduling problem,
Fuzzy Logic, Constraints

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PROBLEMS OF COVID-19 CRISIS IN NIGERIA

Akinduyo Tosin E.

Department of Guidance and Counselling, Adekunle Ajasin University, Akungba-Akoko,
P.M.B 001, Ondo State, Nigeria
tosigno07@yahoo.com

ABSTRACT

COVID-19 pandemic is a snag that was never prepared for by the world at large. The outbreak of COVID-19 muddled all local and international activities/relationships. Indeed, COVID-19 worked like a Trojan to inflict pains on the human race. Though government at all tiers and scientists are working their fingers to the bone to give a decisive defeat to the novel corona virus, efforts are still on a treadmill without a major vaccine for the prevention and treatment of COVID-19. This paper examines COVID-19 squabbles with Nigeria as a case study. This research work reviews the numerous crises that include but not limited to insecurity, coronaphobia, economic strangulation, food scarcity, health concerns, social disorientation and unsuccessful deployment of ICT. The roles of professional counsellors are also discussed in this study. It was recommended that, asides public enlightenment, issues of phobia, depression, anxiety and post-traumatic stress disorder (PTSD) must be shot down as scientists work around the clock to find permanent cure to this novel corona virus.

Keywords: Problems, COVID-19, Professional counsellors and Nigeria

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UNDERGRADUATES' ATTITUDE TO COVID-19 AND THE IMPLICATION FOR MENTAL WELL-BEING

Ahimie B. and Kareem A.A.

Department of Educational Foundations
Faculty of Education
University of Lagos

ABSTRACT

This study presents an online survey of undergraduates' attitude towards COVID-19 Pandemic and its effect on mental well-being. The objectives of the study are to assess the attitude of undergraduates towards COVID-19 and to evaluate its effect on their mental well-

being. The population of the study consists all regular undergraduates in the University of Lagos. Accidental sampling was used to get a sample of 200 students for the study. The questionnaire was sent to undergraduates via WhatsApp. Only those who correctly filled the questionnaire became the sample for the study. An attitude scale to COVID-19 lockdown, developed by the researchers and the Warwick-Edinburgh Mental Well-being Scale (WEMWBS) were used to gather data from the respondents. Two research questions were raised and hypotheses tested at 0.05 level of significance using percentages, Pearson product moment correlation and independent t-test analysis. The result revealed that the respondents are favourably predisposed to the COVID-19 lockdown. It was also revealed that the lockdown had no association with the students' mental well-being. It was recommended that counselling services be provided for students' psychological adjustment after a long break.

Keywords: Attitude, Covid-19 and mental well-being

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CURRICULUM CHANGE TO MEET THE CHALLENGES OF LEARNERS IN THE 21ST CENTURY IN NIGERIA

Itiola Adefisayo Ajibade

Department of Educational Management

University of Lagos, Akoka, Lagos.

iajibade@unilag.edu.ng

ABSTRACT

Curriculum can be defined in several ways, as a group of subject or as a reflection of social thinking. Curriculum is a dynamic concept, with change inherent in its structure, theory and practice and because of this, there has been several curriculum reforms in Nigeria to meet the challenges of the 21st century. The last curriculum reform adopted by Nigeria was developed in 2004 which became operational in 2008 showed the introduction of core and compulsory subject added to the old one. While the conceptual ideas and provisions made are laudable, it is still not sufficient to meet the current challenges in the 21st century because its implementation process is poor and inadequate, consequently, learners in Nigeria are not able to compete favourably with their counterpart in other countries. The paper therefore examines the concept of curriculum, review Nigeria's past curriculum, elucidated on ways to change the curriculum in other to meet the recent challenges of learners in the 21st century. To

achieve these, the paper recommended that there should be massive funding of education by the government, coordinated and effective implementation process of curriculum changed, training of teachers who are the implementers of the changed curriculum, provision of adequate resources.

Keywords: Curriculum, change, implementation, sustainable growth

20C/EDU/012P

**EFFECTS OF FAKE NEWS AND PROPAGANDA ON MANAGEMENT OF
INFORMATION ON COVID-19 PANDEMIC IN NIGERIA**

***Odunlade Racheal O. and Ojo Joshua O.**

University of Lagos Library,

University of Lagos, Akoka, Nigeria

*rodunlade@unilag.edu.ng; jojo@unilag.edu.ng

ABSTRACT

This study seeks to measure the effects of fake news and propaganda in managing information on COVID-19 among the Nigerian citizenry. Up until now, management of information relating to the global pandemic – COVID-19 remains a challenge among nations of the world. Since its emergence, the global village has been continually fed with series of information disseminated via different media ranging from the radio to television, newspapers, internet, social media and even word of mouth. This information keeps coming in the form of news such that it has become almost impossible to differentiate between what is true and what is not. This study aims at examining respondents' reason for spreading fake news, examine how fake news has affected the spread of COVID-19 pandemic in Nigeria, establish the consequences of fake news on managing COVID-19 pandemic and as well identify ways to contain fake news at a time like this in Nigeria. It is an ongoing survey with a sample size that is above 300 participants selected using simple random technique. Instrument of data gathering is questionnaire widely distributed amongst residents in the six geo-political zones of Nigeria using Survey monkey. Source based fake news detection technique will be used to measure the variables of fake news, propaganda and covid-19 information management among the Nigerian populace. Data would be analyzed using frequencies, counts and percentages. Regression analyses would also be carried out on formulated hypotheses. It is believed that findings of this study will shed light on how to identify fake news and uphold the truth even in the face of the outrageous pandemic.

Importantly, policy makers will be guided further by the outcome of this study.

Keywords: COVID-19, fake news, propaganda, Information management, Nigeria

20C/EDU/013P

**INFLUENCE OF CORONAVIRUS DISEASE (COVID-19) LOCKDOWN ON THE
PHYSICAL ACTIVITY STATUS OF NIGERIANS**

***Grace O. Otinwa, Ekundayo V. Ajiborisade, Oluwayomi A. Aoko,
Boluwatife E. Salami and Emike D. Abubakar**

Department of Human Kinetics and Health Education, University of Lagos, Akoka-Yaba,
Lagos

*gotinwa@unilag.edu.ng

ABSTRACT

Coronavirus, the pandemic has forced many people around the world to stay at home and self-isolate for a period of time. The study assesses the physical activity status of Nigerian adults before and during the novel Coronavirus disease (COVID-19) pandemic in Nigeria. Descriptive survey research design was adopted for this study. The self-reported International Physical Activity Questionnaire (IPAQ) was used in data collection. Data collected were analysed using statistical tools such as Microsoft excel, Statistical Package for the Social Sciences (SPSS) all hypotheses were tested using the inferential statistics of paired sample t-test at 0.05 level of significance. Five hypotheses were tested and results indicated that the COVID-19 lockdown effected the total MET, walking MET, and sedentary behaviour of participants - However, the COVID-19 lockdown has no effect on the vigorous and moderate MET of Nigerian adults. The study hereby recommends an inclusive design of roads; work stations and homes such that space will be made available for people to easily carry out daily physical activities. There is a need to adopt the use of fitness mobile technology to help people track their daily physical activity and further research should be carried out to evaluate its influence on a behavioural change towards exercise and physical activities among Nigerians.

Keywords: Physical Activity, Sedentary, Adults, Coronavirus Disease, Pandemic

**LEGAL ISSUES AND REGULATORY FRAMEWORKS FOR ADMINISTRATION
OF ENGINEERING CONTRACTS**

Oluwadare Joshua Oyebode

Civil and Environmental Engineering Department
Afe Babalola University, Ado-Ekiti
Ekiti State, Nigeria
oyebodedare@yahoo.com

ABSTRACT

The knowledge of engineering law, regulatory frameworks and management is important in achieving quality delivery and effective administration of engineering contracts in Nigeria. Since time immemorial, people have been confronted with legal issues especially on planning, administration and implementation of contracts without notable improvement in terms of funding and meeting up with required targets. This paper examined existing legal issues and regulatory framework in the administration of selected engineering contracts. Methods adopted include reconnaissance survey, administration of questionnaire and interview of lawyers, project manager, engineers, client and some stakeholders. The results show that some contractors are not aware of their rights and how to handle conflicts amicably on site. Most issues on projects are related to lack of trust, fear of litigation, inflation rate, government instability, corruption, budget overrun, inadequate manpower irregular payment schedule, and time extension. It is concluded that there is need for improvement in legal system and regulatory framework by all parties involved in contract adjudication. As the world increasingly runs up against physical constraints of time, manpower, time, energy, water and other engineering resources, there is a growing role for implementation of policy to reduce legal issues for timely delivery of projects delivery and efficient *contract* administration. Clients should understand the severity of inadequate funding in contract administration. This paper therefore recommended that government, clients, contractors, consultants and all parties to the contract pay due attention to legal issues and regulatory framework for realization of full potentials of contracts and in order to carry out their duties without conflict.

Keywords: Contact Adjudication, Clients, Legal Issues, Regulatory Framework, Management,

**PHYSICO-MECHANICAL PROPERTIES OF RAFFIA-FIBRE-REINFORCED
EPOXY AND POLYESTER COMPOSITE**

Amuda M.O.H. *, Lawal F.T., Etuk N.N., Tiamiyu J. and Aikhomu I.V.

Materials Development and Processing Research Group (MADEPREG), Department of
Metallurgical and Materials Engineering, University of Lagos, Lagos, Nigeria 101017

*mamuda@unilag.edu.ng

ABSTRACT

The present work characterised the physico-mechanical properties of raffia-fibre reinforced epoxy and polyester composites in relation to some experimental parameters. This was done to address the challenge of surface condition of reinforcing materials on the structural stability of polymeric composite. Sodium hydroxide surface modified raffia-fibre were incorporated in the polymer matrixes at different loading rates using hands layup technique. The influence of surface modification on water absorption rate, biodegradability and tribological properties of the polymer matrix composites were analysed using gravimetric, soil burial/compost conditions/optical microscopy, and pin-on-disk techniques, respectively. Such additional properties as hardness, tensile strength, flexural strength and impact energy of the fibre-reinforced composites were equally investigated. Analysis of the results indicated that untreated raffia-fibre reinforced composite exhibited better water absorption behaviour than those composite reinforced with treated raffia-fibre irrespective of the matrix. Biodegradability is about 12% better in polymer composite reinforced with surface modified raffia-fibre unlike those reinforced with untreated raffia-fibre. Hardness in treated raffia-fibre reinforced polymer composite was about 20% and 60% higher in epoxy and polyester polymeric composite, respectively than untreated raffia-fibre reinforced polymer composite. However, within the composite type, epoxy composite exhibited higher hardness at 175 BHN compared to 168 BHN in polyester composite. Improved tensile and flexural strengths were obtained in both treated and untreated polymer composite irrespective of the loading concentration of the reinforcement. However, impact strength is more significantly affected by the surface characteristics of the raffia-fibre as well as the loading concentration of the fibre in composite. These findings suggest that surface treatment of reinforcement materials enhanced the biodegradability and impact strength of raffia-fibre reinforced polymeric composites irrespective of the loading concentration of the reinforcement.

Keywords: Biodegradability, mechanical-properties, polymer-matrix, raffia-fibre

concentration, surface-modification.

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THE PRESENT AND FUTURE OF ARTIFICIAL INTELLIGENCE

Henry S. Okeke and Michael A. Taiwo

Department of Electrical/Electronic Engineering,

The Federal Polytechnic Ilaro, Ogun State, Nigeria

michael.taiwo@federalpolyilaro.edu.ng; henry.okeke@federalpolyilaro.edu.ng

ABSTRACT

Every individual longs to be engaged in a task that is easier, faster, and time saving. These yield an increased output and an improved efficiency. In the quest for sophistication, human beings have consistently developed and improved various technologies. In the worlds technology of today, Artificial Intelligence (AI), Robotics, and Deep Learning System is fast trending. All these make our work very fast, easy and even much more reliable. These innovations are visible in Industries, Autonomous Vehicles (Self driving cars), Defense, Educational sector, HealthCare, Power sector where Artificial Neural Network are used for fault detection, amongst others. This paper seeks to examine some areas of application of A.I. Numerous consultations were carried out from the previous academic research, books, and journals that relate to the issue. An approach of a descriptive analysis of qualitative variables was used. Using that approach, 50 people were interviewed on how its usage has influenced their daily lives. Questionnaires were administered to the 50 workers cutting across different sectors of the country. 70% of these workers attested that AI has greatly influenced their day to day activities, 20% failed to recognize its role in their daily activities and the remaining 10% do not know whether it has played any part at all. With these data gotten, it is envisioned that in years to come, Artificial intelligence may likely affect a larger part of what we do daily as human, and as such, we need to also move along technologically.

Keywords: Artificial Intelligence, Robotics, Autonomous Vehicles, Artificial Neural Network.

ENHANCEMENT OF IoT-BASED REAL-TIME SOLAR POWER MONITORING SYSTEM USING 5G TECHNOLOGY

¹Bitrus I. and ²Adamu P.I.

¹Department of Electrical/Electronic Engineering
The Federal Polytechnic Ilaro, Ogun State, Nigeria.

²Department of Aerospace Engineering
Air Force Institute of Technology (AFIT), Kaduna, Nigeria
irmiya.bitrus@federalpolyilaro.edu.ng

ABSTRACT

With the aid of Internet of Things (IoT) Technology, remote supervision of solar power system could be achieved so as to ascertain its performance characteristics. With the advent of 5G technology, the time lag in real-time communication between the Graphical User Interface (GUI) and the NodeMCU will be greatly reduced; this will in turn enhance the accuracy and precision of the parameters been monitored such as: voltage, current, dust on the solar PV panels, amount of incident solar radiation on PV panels, system temperature, ambient temperature, etc. This paper presents the possibility of enhancing the efficiency of IoT-based smart monitoring system in solar power system using millimeter wave (mmWave)-based 5G network which has a data rate of up to 6.5Gbps for downlink and 3.5Gbps for uplink as compared to 4G LTE which has 2.0Gbps and 1Gbps for downlink and uplink respectively. Relevant sensors (voltage and current) were used to collect the data in real-time. The Arduino Integrated Development Environment (IDE) was used to compute the input and output power of the system. These data are then transferred over the internet using the Arduino-compatible board called NodeMCU. The reported real-time data were received on smart phone using Android Mobile application. The time response when 5G network was simulated was 65% faster than when 4G LTE was used. It is therefore recommended that 5G technology be used in remote monitoring and maintenance of solar power system so as to reduce the transportation cost to the site, minimize risk of road accident and reduce the Mean Time To Repair (MTTR), hence, improve the system reliability.

Keywords: IoT, Solar Power, 5G Technology, Performance enhancement

A QUALITATIVE COMPARATIVE STUDY OF ITERATIVE AND NON-ITERATIVE LOAD-FLOW METHODS: NEWTON-RAPHSON AND HOLOMORPHIC EMBEDDING APPROACHES AS CASE STUDIES

***Olobaniyi, F.A., Oparinde, O.A. and Ogundipe O.I.**

Department of Electrical and Electronics Engineering, Faculty of Engineering, University of Lagos, Nigeria.

* folobaniyi@unilag.edu.ng

ABSTRACT

In view of the importance of load flow analysis for successful planning and operation of power systems, there is an increasing need for power flow methods that would give accurate results and in addition be devoid of convergence issues that are typical of the classical iterative methods. This has given rise to the innovative Holomorphic Embedding Load-flow Method (HELM) that is non-iterative and could find a solution when it exists and indicate when there is no solution, such as in the case of voltage collapse. Documented evidences over the years show that the NRLM is the most commonly used iterative method due to its superior advantages, therefore, it is chosen for the comparison. The objective of this paper is to weigh up the merits of HELM over the Newton-Raphson load flow method (NRLM) based on information obtained from actual applications. At the end of the solution process, HELM was found to be 4.33% faster than the NRLM for the IEEE 4-bus system and 19.31% faster when applied to the Nigerian 330kV network; this validates a major advantage of HELM over iterative solutions. HELM is not found as one of the methods previously applied for analysis of the Nigerian network and yet could help to detect voltage collapse early. Secondly, though special software was produced for HELM and might be the best for it, attempt was made to develop a MATLAB program for easy accessibility. However, more work is required in the programming to successfully analyse large or ill-conditioned systems.

Keywords: convergence, holomorphicity, Jacobian, approximants

TIME-ENERGY OPTIMAL TRAJECTORY PLANNING FOR POINT-TO-POINT INDUSTRIAL ROBOT ARMS

Raji A.A., Asaolu O.S. and Akano T.T.

Department of Systems Engineering,
Faculty of Engineering, University of Lagos, Nigeria.
aaraji@unilag.edu.ng; oasaolu@unilag.edu.ng; takano@unilag.edu.ng

ABSTRACT

Global warming coupled with growing restrictive global government policies to reduce energy wastage and carbon footprint have pushed most industries towards sustainable manufacturing solutions. COVID-19 pandemic, on the other hand has created quite a number of new normals and as social distancing rules are enforced, more robots would be deployed as part of the paradigm shift in the industrial sector. This makes a reduction in cycle time and energy consumption of industrial robot arms a key issue for researchers. This study seeks to develop an offline time-energy optimal trajectory planning scheme for pick-and-place robot arms. The planned trajectory aims to minimize a multi-objective cost function which is a weighted balance of time and energy subject to requisite kinematic and dynamic constraints. Essentially, the problem of trajectory planning for robotic manipulators is best resolved using multiple criteria. The resolution of such problems can benefit from the multi-objective optimisation, particularly when the objectives are conflicting. A trigonometric spline was used as an interpolating function to generate the trajectory in the joint space which leads to a non-linear optimisation problem. Grey Wolf Optimisation (GWO) algorithm was used to solve the optimisation problem due to its ability to handle complex problems with limited understanding of the search space. The time-energy savings of the proposed trajectory planning scheme is verified by simulating a number of tasks using the MATLAB Robotics Toolbox. The preliminary results are encouraging as a smooth trajectory was achieved with a good convergence rate.

Keywords: industrial robot; manufacturing; trajectory planning; manipulators, time-energy optimisation

**DEVELOPMENT OF SELECTED AGRO FORESTRY WASTES PARTICLES
REINFORCED POLYMER COMPOSITES AS A SUITABLE SUBSTITUTE FOR
ASBESTOS-BASED AUTOMOBILE BRAKE PADS**

Ajibade Oluwaseyi Ayodele and Agunsoye Johnson Olumuyiwa

Department of Metallurgical and Materials Engineering

University of Lagos, Nigeria

oajibade@unilag.edu.ng

ABSTRACT

This study is anchored on the need to develop green polymer composites for application in automobile brake pad as substitutes to asbestos-based brake pads which are known for their carcinogenic effect on human life and environment. The composites were developed from selected agro-based particulate fillers. In this study, polymer composites were developed with particulate blend of orange peel, coconut, periwinkle, palm kernel and egg shells via a top-down procedure. The mechanical properties of the developed composites were appraised in accordance to ASTM D2344, D256, D2583 standards for flexural, impact and hardness tests, respectively. Five composites with the best mechanical performance requisite were used for the dry sliding wear test on a DIN Abrasion Tester (model FE05000). Thereafter samples were characterised for phase identification, thermal stability, microstructural examination and elemental composition using the X-Ray Diffraction (XRD), Thermogravimetric Analysis (TGA), Scanning Electron Microscopy (SEM) and Energy Dispersive Spectroscopy (EDS), respectively. The developed green composites apart from it being eco-friendly and asbestos free, shows improved wear resistance with orange peel/coconut shell (0.75-3), palm kernel/coconut shell (0.9-1.5) & periwinkle/egg shell blends (0.19-0.64 mm³/N.m) being superior to that of the commercial grade (0.65-3.64 mm³/N.m), using the Agarwal wear rate equation. From the TGA, the thermal stability of the developed composites (T_g: 680-820°C) was found superior to the commercial grade (T_g:680°C). In conclusion, the developed composites are suitable materials for automobile brake pad application which are subject to wear and thermal fluctuations. The final composite can be domesticated locally for brake pad production Its adaptation and usage will help rid the carcinogenic effect caused by the use of asbestos-based brake pads on human life as well as reduce the indiscriminate dumping of agro-waste materials.

Keywords: Composites, wear, Taguchi optimisation, mathematical model

20C/ENG/010P

THE ECONOMY OF WASTE PLASTIC MODIFIED MASONRY UNITS IN THE CONSTRUCTION OF RESIDENTIAL BUILDINGS

^{1, 2*}Uche Emmanuel Edike and ²Okon John Ameh

¹ Department of Building Technology, Bells University of Technology, Ota, Nigeria

²Department of Building, University of Lagos, Akoka, Lagos, Nigeria

* euedike@bellsuniversity.edu.ng

ABSTRACT

The surging housing deficit in some developing economy is increasingly alarming, and the effect is a consistent rise in house rent occasioned by high cost of conventional walling materials. This study investigated the construction cost of building a three-bedroom flat with sandcrete blocks (SBs), eco-bricks (EBs) and polymer bricks (PBs) to guide policy towards the application of alternative walling units for the construction of affordable houses. The study employed a quantitative approach to evaluate the comparative cost of masonry wall construction of a typical three-bedroom residential building in Nigeria using any of the three masonry units. Physical measurement of the three-bedroom bungalow was conducted from the foundation through to the roof beam. Prices of eco-bricks and polymer bricks were computed based production experience of the masonry units, while the price of sandcrete block was obtained from block moulding firms in Lagos, Nigeria. The findings revealed that a total cost of ₦ 3, 346, 687.10, ₦ 2, 038, 574.92 and ₦ 2, 216, 157.10 were found for SBs, EBs and PBs walls respectively. The differences in cost with reference to SBs walls were found to be ₦ 1, 308, 122.18 and ₦ 1, 130,540.00, representing approximately 39% and 34% cost savings for eco-bricks walls and polymer bricks walls respectively. The import is minimum construction cost, without compromise of aesthetic and strength values. The study suggests the use of eco-bricks and polymer bricks for construction of low-cost buildings.

Keywords: Alternative masonry units; Cost analysis; Construction; Eco-bricks; Polymer bricks

**GEOSPATIAL ASSESSMENT OF SELECTED NIGERIA POLICE FORCE (NPF)
CAPABILITIES IN PART OF KADUNA SENATORIAL ZONE II, KADUNA STATE**

***¹Bala A., ¹Isioye O.A., ²Okolie C.J., ¹Aliyu A.O. and ¹Salman A.K.**

¹Department of Geomatics, Ahmadu Bello University, Zaria-Nigeria

²Department of Surveying and Geoinformatics, University of Lagos, Nigeria

* abala@abu.edu.ng

ABSTRACT

This study examined the geographical distribution of Police Stations and facilities in part of Kaduna Senatorial Zone II, Kaduna State. Mobile Topographer Application was employed to obtain geographical coordinates of the police stations and some outposts; while the attribute data related to police personnel in each station were obtained through administration of questionnaire. ESRI ArcGIS v10.5 software was used to map out and analyse the distribution of the police stations and other police facilities. The pattern of police station allocation in the study area was mostly sporadic and inconsistent as shown from the results, with a little clustering at the centre. Buffer zones were created at a radius of one kilometre and two kilometres, and the result showed that the city of Kaduna is fully served. The high strength of Police at Igabi Local Government Area was attributed to large population in the area. Kaduna South Local Government Area had least number of police stations and it was the smallest in police force; it accounts for only 13 per cent of the study area's overall police strength. The ratio of police officer to population in the area is 1: 1318 which is far below the recommended figure of 450 per police officer endorsed by United Nation. The study recommended that population dispersal ought to be a substantial influence in the allocation of police stations and police personnel. Training of police personnel on the use of geospatial technology for surveillance and decision making should be accorded a priority.

Keywords: Nigerian Police, Facilitates, Security, Kaduna, Geospatial Assessment

COVID-19 AWARENESS MAPS FOR NATIVE SPEAKING COMMUNITIES IN KATSINA STATE, NIGERIA

*** ¹Bala A., ¹Aliyu Y. A., ¹Youngu T.T., ²Okolie C.J. and ²Igwe V.C.**

¹Department of Geomatics, Ahmadu Bello University, Zaria-Nigeria

²Department of Surveying and Geoinformatics, University of Lagos, Nigeria

* abala@abu.edu.ng

ABSTRACT

Nigeria reported its first case of the novel coronavirus (COVID-19) infection in February 2020. The COVID-19 attained World Health Organisation (WHO) pandemic status a month later. As at 13th August, 2020, over 48000 cases have been confirmed in the country with at least 950 deaths. Katsina State recorded its first death on the 7th of April, 2020. Since the outbreak of the disease, several initiatives in the government and not-for profit sectors have been directed at mapping its spread and diffusion using maps produced by Geographical Information Systems (GIS). Much of the COVID-19 case statistics and information displayed on the maps are comprehensible by the better-informed public, but does not cater to the local context of many citizens with little or no understanding of the English language. Also, most people in northern Nigeria, including those who do not have formal education speak, read and write in Hausa language. To effectively mitigate the outbreak of the disease in Katsina State, efforts are needed to increase public knowledge and awareness of the disease. Hence, the aim of this study was to map the occurrence of COVID-19 in Katsina State, northern Nigeria at the Local Government level and present the maps in a form easily understood by the locals. Using readily available COVID-19 data, situation maps of the disease were created with ArcGIS 10.7 and ArcGIS Online cloud-based GIS mapping software. The spatial dispersion of the disease across the state was also analysed with standard deviational ellipses and the relationship between the population and number of confirmed cases was analysed using Pearson's correlation. With local knowledge, Google translator and consultations with a Hausa media practitioner, the COVID-19 case statistics and map textual information were translated to Hausa. The localised maps were disseminated via interactive social media platforms and this increased awareness among the local citizens. The maps are easy to read and interpret with the potential of reducing the spread and transmission of the COVID-19.

Keywords: GIS, ArcGIS, Localised maps, COVID-19, Hausa Language, Katsina.

**IMPACT OF ABATTOIR EFFLUENTS ON THE QUALITY OF SURFACE WATER
AT ODO-ERAN STREAM SABO, ILARO**

Olugbenga Babajide Soyemi and Olumuyiwa Abidemi Aikulola

Department of Civil Engineering
The Federal Polytechnic, Ilaro
jidesoyemi@federalpolyilaro.edu.ng

ABSTRACT

The problems of getting quality potable water are increasing as untreated effluents are discharged into the surface water bodies particularly in rural areas where the rivers are the sources of water. The impact of the effluent from Sabo abattoir in Ilaro town of Yewa South Local Government Area of Ogun State on the physicochemical parameters of the adjoining river was investigated. The qualities of the stream water before and after mixing with the effluent were studied using basic water quality parameters and equipment. The results showed that pH ranged from 6.25-6.75, temperature from 24.43-25.73⁰C, total solids from 100-1200mg/l, total suspended solids from 81.45-1140.3mg/l, total dissolved solids from 18.55-59.7mg/l, acidity from 19-123mg/l, alkalinity from 50-520mg/l, biological oxygen demand (BOD) from 9.473-127.58mg/l, and dissolved oxygen from 2.856-13.06mg/l. These results showed that the contamination was higher at and after the effluents were introduced into the river. The water quality after the discharge of effluents weakened mainly due to releases of untreated effluents from the abattoir. Using Prati *et al.* classification of surface water quality, Odo-Eran Stream fell in the class of grossly contaminated water after mixing with the abattoir effluents. Hence the abattoir effluents need to be treated before releasing into the watercourse and a level of hygienic practices are maintained.

Keywords: Abattoir, Effluents, Surface water, water quality, treatment

**KNOWLEDGE AND PERCEPTIONS OF NOISE POLLUTION AT THE
UNIVERSITY OF LAGOS MAIN CAMPUS**

¹Alfred S. Alademomi, ^{1*}Chukwuma J. Okolie, ¹Babatunde M. Ojebile, ¹Olagoke E. Daramola, ¹Johanson C. Onyegbula, ¹Rahmat O. Adepo and ²Wemimo O. Ademeno

¹Department of Surveying and Geoinformatics, Faculty of Engineering,
University of Lagos, Nigeria.

²Department of Surveying and Geoinformatics, D.S. Adegbenro Information, Communication
and Technology Polytechnic, Ogun State, Nigeria.
cokolie@unilag.edu.ng

ABSTRACT

In the face of increasing exposure to various environmental pollutants, the peculiarity of noise has made it to pervade even well-structured societies. Despite its contribution to deteriorating health conditions and quality of life, it is seen as a normal phenomenon by many urban dwellers. The yearly rise in students' enrolment coupled with increasing social and commercial activities has led to unusually high noise levels at many university campuses in Nigeria. This study assessed the knowledge and perceptions of noise levels within the University of Lagos main campus. Noise levels at 34 locations were measured over a 3-day period using the Extech 407730 sound level meter and compared with standards set by the National Environmental Standards and Regulations Enforcement Agency (NESREA) and World Health Organisation (WHO). Using a geographic information system (GIS), the spatial variation in the noise levels was analysed and an opinion pool of staff and students was sampled with a well validated online questionnaire survey that inquired about the likely contributory sources of noise. The findings revealed that the noise levels generally exceeded the tolerable limits for academic environments. Common noise-related problems reported by the survey participants include increased distractions, loss of concentration, and issues of health and mental wellbeing. It is recommended that immediate measures be put in place to checkmate the negative impacts of prolonged noise exposure at the University of Lagos and other university campuses nationwide.

Keywords: Noise Level, Noise pollution, Noise mapping, Geographic information system, University of Lagos.

**MULTI-CRITERIA DECISION ANALYSIS OF WIND ENERGY VIABILITY IN
THE LAKE CHAD AREA – INTERIM RESULTS**

¹*Okolie C.J., ²Amusan T.O., ¹Daramola O.E. and ¹Uyo I.I.

¹Department of Surveying and Geoinformatics, Faculty of Engineering, University of Lagos

²Department of Electrical Engineering, Faculty of Engineering, University of Lagos

* cokolie@unilag.edu.ng

ABSTRACT

The Lake Chad Basin is located at the south of the Sahara Desert in an arid region. The lake and the surrounding areas are under severe pressure due to climate change and increasing irrigation demands. There is therefore an urgent need to diversify the energy requirements. In this study, a multi-criteria assessment of wind energy viability in the Lake Chad area was carried out. The study examined hourly wind speeds ranging from 2 – 17m/s of 5 stations (Stations 1 – 5) for periods ranging from 35 to 45 years at 10m height. The stations are located in Borno State, Nigeria and adjoining areas within Niger and Chad. Based on the globally and literature-backed accepted Weibull fit and methodology for wind speeds data, the classification of the sites was done based on National Renewable Energy Laboratory (NREL). The factors influencing wind energy potential were operationalised in an Analytical Hierarchical Process (AHP) modelling within a Geographic Information System to map the wind energy potential. The results showed that 3 of the stations were extremely viable for wind energy generation. Stations 1, 4 and 5 were identified to have high capacity to generate electrical power and were classified into wind class 7. Their individual power densities are 2780W/m², 799W/m² and 474W/m². Station 2 was not viable for wind energy generation with a power density of 35W/m² while Station 3 requires adequate consideration for wind energy harnessing due to its power density of 123W/m². These results provide further impetus for the government and policy makers to ensure sustained investment in renewable energy resources in the Lake Chad area and in Nigeria.

Keywords: Renewable Energy, Wind Energy, Analytical Hierarchical Process, Geographic Information System.

MONITORING AND PREDICTING LAND COVER CHANGES IN ANAMBRA RIVER BASIN

Nwilo P.C., *Njar N.G., Inyang U.B., Daramola O.E., Okolie C.J. and Orji M.J.

Department of Surveying and Geoinformatics, Faculty of Engineering, University of Lagos,
Lagos, Nigeria.

* gertrudennjar@gmail.com

ABSTRACT

Land cover change is a global phenomenon that has taken the attention of researchers in the geospatial sciences and allied fields. Practices such as deforestation, agriculture and infrastructural development alter land cover and can also compromise the hydrological balance of the natural environment. Over the years, little has been done in assessing the current and future land cover changes in river basins in Nigeria, but not in the Anambra River Basin. This study investigates the spatio-temporal variations in land cover within the Anambra River Basin of south-eastern Nigeria at three periods: 1987, 2000 and 2018. Additionally, the future scenario of land cover was predicted for the year 2030. The land cover classification was done using the Neural Network classifier in the ENVI 5.3 software environment while the prediction was implemented with the Cellular Automata (CA) Markov chain modelling tool in IdrisiTerrSet 18.31 software. Results show that between 1987 and 2018, there was a loss of 14km² (23%), 54km² (22%) and 771km² (37%) in the water bodies, wetlands and vegetation classes respectively. In the same period, there was a gain of 161km² (50%), 684km² (8%) and 74km² (23%) in the aerial extent of built-up areas, agricultural land and barren lands. The explanation for this outcome is connected to the rise in human population within the basin which has increased the demand for agricultural land, infrastructural development and housing. The land cover projection between 2018 and 2030 shows a loss of 894km² (10%) and 127km² (32%) in agricultural land and barren land respectively whereas there was a gain of 43km² (9%) in built-up areas. It is recommended that sustainable conservation practices and good land cover management policies be established to safeguard the river basin.

Keywords: Land cover change, Land Cover Prediction, Neural Network, Cellular Automata, Markov Chain.

**DESERTIFICATION RISK ASSESSMENT OF BAUCHI STATE, NIGERIA USING
THE MEDALUS MODEL**

**Nwilo P.C., Olukayode S.J., Okolie C.J., Daramola O.E.*, Salami T.J., Uyo I.I., Umar
A.A.**

Department of Surveying and Geoinformatics, University of Lagos, Lagos, Nigeria

* olagoke.daramola@gmail.com

ABSTRACT

As a dynamic process that influences large area of land, desertification stands out among the present challenges experienced in northern part of Nigeria. The impacts of this phenomenon have undermined the maintainability of natural assets like water resources, agricultural production, general habitation, and cattle rearing which is one of the dominant economic activities in the region. This study assesses the risk of desertification in Bauchi state, Nigeria using the MEDALUS model (Mediterranean Desertification and Land Use) with Geographic Information System (GIS) technology. The MEDALUS model made use of factors such as soil, climate, vegetation and management. These factors were combined and computed mathematically to arrive at the Desertification Sensitivity Index map which shows the areas that are sensitive to desertification in the study area. The result of this study shows that 0.05% (22.588 km²) of the study area covering places such as Gamawa, Dambar, parts of Bagoro, Darazo, Kirfi, and Toro have very high sensitivity to desertification, 10.07% (4925.698 km²) covering Misau and Alkaleri Local Government Areas (LGAs) have high sensitivity, and there is moderate sensitivity to desertification at Shira, Zaki, Jamaere, Ningi, Tafawa – Balewa, Ganjuwa and Katagum LGAs covering 68.68% (33591.28 km²) while 21.21% (10371.62 km²) of the study area covering Warji, Giade and Dass LGAs have low sensitivity to desertification. These findings show that the largest part of the study area is moderately sensitive to desertification. The general sensitivity of the study area to desertification calls for mitigation measures to decelerate the process of land degradation in northern Nigeria.

Keywords: Mediterranean Desertification and Land Use; Desertification; GIS; Landsat; Desertification Sensitivity Index

A WATERSHED-BASED SURFACE RUNOFF ESTIMATION FOR LAGOS AND OGUN STATES, NIGERIA

Nwilo P.C., Banjo O. A., *Daramola O.E., Okolie C.J., Ogbeta C.O., Uyo I.I.

Department of Surveying and Geoinformatics, University of Lagos, Lagos, Nigeria

* olagoke.daramola@gmail.com

ABSTRACT

The rapid growth of populations has put severe strain on soil and water resources in developing countries. This has also upset the delicate ecological balance in the environment and led to frequent incidents of flooding and other hydrological disasters. Hence the need for the development of the earth's natural resources on the basis of hydrological units like watersheds. This study employed Remote Sensing (RS) and Geographical Information System (GIS) techniques in carrying out watershed-based surface runoff estimation for Lagos and Ogun States. The Advanced Land Observing Satellite (ALOS) Digital Elevation Model (DEM) was used for the extraction of drainage networks from which the watershed basin was delineated. The runoff was calculated using the modified Soil Conservation System (SCS) Curve Number (CN) method. The runoff estimation used parameters such as land cover, rainfall, soil texture and delineated watershed sub-catchments. Rainfall data and soil map were used to calculate the antecedent moisture condition (AMC II) and hydrological soil group (HSG) map respectively. The intersection of the HSG and the land cover classes was looked up in the SCS CN table for CN values. The CN values and the rainfall depth were further used for the calculation of the runoff depth. The result of the watershed delineation reveals that the catchment covers a total area of 17647.71km² with a total number of 158 sub-catchments. The runoff zonation map reveals that 22.72% of the watershed area has a very high runoff depth range (957.93mm – 106.32mm); 39.44% area of the watershed has a high runoff depth range (847.87mm – 957.93mm). Also, 27.26% of the area has a moderate runoff depth range (747.39mm – 847.85mm) and 10.57% of the area with a low runoff depth range (656.48mm – 747.39mm). The results of this study provide a knowledge-oriented approach to combating hydrological disaster such as flooding in Lagos and Ogun States.

Keywords: Watershed, Runoff, Curve number, Drainage networks, Hydrological soil group.

**LONG TERM MONITORING OF BATHYMETRIC CHANGES IN THE
COMMODORE CHANNEL, LAGOS STATE**

¹Nwilo P.C., ¹*Anibaba B.A., ¹Okolie C.J., ¹Orji M.J., ¹Daramola O.E. and ²Azuike C.

¹Department of Surveying and Geoinformatics, Faculty of Engineering, University of Lagos,
Lagos State, Nigeria.

²Nigerian Navy Hydrographic Office, Lagos Nigeria.

* tundeanibaba@yahoo.com

ABSTRACT

Bathymetry provides information on the depths of water bodies and has found wide applications in port and harbour planning, coastline change assessment, river sedimentation analysis, and pre and post dredge survey assessment. Bathymetric surveys are a reliable method for monitoring changes in riverbed topography and provide data from which morphological parameters are estimated. The Commodore Channel in Lagos State is located at the seaside entrance into the Lagos Harbour thus exposing it to the action of dynamic coastal forces such as high waves, tidal currents, and storm surges. The combined effects of these forces affect the stability of the sediments on the channel's seabed. The aim of this study is to monitor the changes in the channel's bathymetry using data on water depth from a time series of bathymetric charts covering the channel at the following periods: 2008, 2010, 2012, 2014, 2016, 2018. The charts were acquired from the Nigerian Navy Hydrographic Office (NNHO), scanned and georeferenced. The depths were digitised within the ArcGIS 10.4.1 software environment using Inverse Distance Weighted (IDW) interpolation, bathymetric surfaces were produced and coincident points for depth comparison were extracted. The results from the quantitative analysis showed an average increase in the channel's depth from 0.278m in 2008 to 0.672m in 2018. From 2008 - 2010, and 2014 - 2016, the surface water volume of the channel decreased by 8,378,033.423m³ and increased by 4,360,403.472m³ respectively. These fluctuations in channel volume might be connected to dredging works by the government at the channel aimed at increasing the depth to accommodate larger shipping vessels entering Lagos Harbour. There is need for further investigation on the impact of the observed changes and dredging works on the sensitivity of the channel environment.

Keywords: Hydrography, Bathymetry, Inverse Distance Weighted Interpolation, Surges, Topography.

**INNOVATIVE MANAGEMENT OF WATER RESOURCE FACILITIES FOR
PUBLIC HEALTH AND SUSTAINABLE DEVELOPMENT IN NIGERIA**

Oluwadare Joshua Oyebo

Civil and Environmental Engineering Department
Afe Babalola University, Ado-Ekiti
Ekiti State, Nigeria
oyebodedare@yahoo.com

ABSTRACT

It is widely acknowledged that water resource facilities must be managed effectively for improved health and achievement of sustainable development goals. Many of Nigerian water resource facilities are not meeting world health organization and international standards due to lack of innovation and sustainability orientation of agencies in water sector. This paper focused on innovative management for addressing impending issues regarding water resource facilities, economic environment, regulatory framework, water quality standards for sustainable healthcare. Methodology adopted includes reconnaissance survey and collation of secondary data from government agencies. The result of the analysis showed that innovative management has not been embraced in most water development project and the issue of sustainability has been hampered by inadequate funding. The conclusion made include formulation of policy and encouragement of researchers for management, restructuring and maintenance of facilities in water sector. Innovative management cannot be achieved without population forecasting and quality funding. Finally, the study advocated for integrated and multidisciplinary approach in the planning and implementation of water supply projects. Research tailored towards innovative management should be funded with great prioritization by government.

Keywords: Innovative, Sustainability, Integrated, Management, Water Resource Facilities

**A REVIEW OF THE REGULATORY ARCHITECTURE AND NORMATIVE
FRAMEWORK ON SUSTAINABLE WATER RESOURCES IN NIGERIA**

¹Kolawole Omoyajowo Esq. and ²Temitope Waleola

¹Mountain & Hill Attorneys, Lagos

²E-waste Relief Foundation, Lagos

*kolaomoyajowo@gmail.com

ABSTRACT

Water plays an immutable role in driving the country's economic growth especially while considering the maritime industry, agricultural sector, mining and minerals sector, infrastructure construction etc. However, industrialisation and commerce pose a threat to the sustainability of water resources through unabated water pollution. In consequence, water resources, aquatic organism, human lives and livelihood continue to be endangered. The need to ensure the sustainability of water accounts for why it occupies a goal in the Sustainable development Agenda. To this end, this research reasoned that central to the galvanisation of efforts to ensure water sustainability in Nigeria is the role of laws, policies, regulations and institutions. Hence, this research critically reviewed all the regulatory architecture and normative frameworks that provide for legal and policy strategies for achieving water sustainability in Nigeria. Qualitative research methodology was primarily used to carry out this research. Statistical research tools such as bar charts and pie charts were employed to analyse the existence of legal framework across the various channels through which the water resource is being threatened. Content and contextual analysis of normative standards against water pollution was painstakingly done. The research therefore found out that there exist inadequate regulatory standards and policy strategies to combat water pollution in Nigeria. Furthermore, this research revealed, among others, that the legislations on water resources management in Nigeria is out-dated considering the trends in global legal strategies for ensuring water sustainability. In conclusion, this research clamoured for an overhaul reform in legislations on water resource management and pollution control in Nigeria.

Key words: water, sustainability, legislation, pollution & policies

**ACHIEVING SUSTAINABLE PRIMARY HEALTH CARE THROUGH GREEN
ARCHITECTURE IN URBAN COMMUNITY, LAGOS STATE, NIGERIA**

Babalola A.O. and Adedeji D.

Department of Architecture, University of Lagos, Nigeria
doyinbabalola@unilag.edu.ng

ABSTRACT

With numerous environmental, health and human challenges affecting diverse nations, including the ongoing pandemic that has sickened hundreds of thousands of people and claimed thousands of lives, the global community is battling to contain and stop the spread. Green Architecture is an approach to building that minimises harmful effects on human health and the environment. Incorporating Green Architecture in Primary Health Care system will contribute to the reduction of pollution, conservation of natural resources and making essential health care universally accessible to individuals and families in the community. This paper, therefore, proposes various intervention of Green Architecture to achieving sustainable Primary Health Care and promoting preventive and pro-active measures to improving existing Primary health care conditions. The sources of data were from observations, a field study and analysis of various case studies as well as a study of various situations and responses to the ongoing pandemic. The study shows that the existing situation of Primary Health Care centers in the selected urban community is generally poor and lacking in basic infrastructure to meet required needs. It is imperative that researchers in the built environment engage communities and the primary health care system to respond and develop an international frame work for safe, healthier, effective and sustainable community.

Keywords: Environmental Sustainability, Green Architecture, Primary Health Care (PHC), Urban community

**AN ASSESSMENT OF VOCATIONAL AND TECHNICAL EDUCATION OF
ARTISANS IN NIGERIA**

¹*Aderemi Aderogba, ¹Ikenna Awani and ²Abigael Oluniyi

¹Department of Building, University of Lagos, P.M.B 1005, Lagos. Nigeria.

²School of Vocational & Technical Education, Adeniran Ogunsanya College of Education,
Oto-Ijanikin, Lagos State

*aaderogba@unilag.edu.ng, awaniikenna@gmail.com, olatoyosioluniyi@gmail.com

ABSTRACT

Vocational and Technical Education (VTE) have become imperative in the 21st century considering the significant role it plays to the socio-economic development of every society. In order to cope with the requirements of fast developing economy, to gear up employment generation and meet the challenges of globalisation, it was absolutely imperative to realign Vocational and Technical Education system in the country to cater for these requirements. This research is aimed at assessing the present state of VTE in Nigeria and identifying the reasons for its current state. A survey method using a well-structured questionnaire was employed as the instrument for collection of data. The questionnaires were distributed to professionals and artisans in the construction industry. A total of ninety-three questionnaires were retrieved from the construction professionals and artisans. Selection was done using random sampling. Descriptive statistics tools including frequency, percentage, total sum and mean were used in analysing. 65% of the professionals and artisans sampled agreed that present state of VTE in Nigeria can be rated as below acceptable standard which is owed to the reduced emphasis on apprenticeship training method, inadequate involvement of organised private sectors in vocational/technical education and training and lack of commitment to technical and vocational education on the part of the government. The study concludes that the quest for improved skill acquisition and youth empowerment could be achieved if vocational and technical education is aggressively enhanced by injecting funds into Polytechnics and technical education and ensuring that strict international guidelines are adhered to in teaching and training. Therefore, the study recommends that the nation's policies and programmes be adequately strengthened to address the challenges facing VTE in Nigeria.

Keywords: Vocational Technical Education, Artisans and Training.

20C/ENV/004P

THE INTEGRATION OF HYDROPONIC GARDEN PRINCIPLE IN BUILDINGS IN METROPOLITAN LAGOS

***Taiwo Oke, Adedoyin O. Babalola and Anthony Iweka**

Department of Architecture, University of Lagos, Nigeria

*toke@unilag.edu.ng

ABSTRACT

Traditional farming practice (i.e. non-high tech) continues to this day to produce massive loss to topsoil coupled with the rapidly and continuous loss of arable lands to construction as a result of the large inflow of people from rural areas to metropolitan cities. It is also not sustainable to provide adequate products for the rapid population growth. In a bid to proffer solution to these problems, there must be a synergy between Architecture and Agriculture. This paper aims at studying and integrating the concept, system and principles of hydroponic farms to buildings by leveraging the co-action that exists between building and agriculture. An in-depth review of relevant literature will be done in order to identify the concept, systems and principles of hydroponic farming and vertical farms and to determine the appropriate strategies of infusing vertical farms to the Architecture of buildings in tropical regions (Lagos). The findings of this study suggest that an integrated and well-engineered approach to building and farming can greatly reduce the agricultural footprint, promote healthier living standards, social interaction and communal living in metropolitan Lagos.

Key words: Architecture, Agriculture, Buildings, Hydroponic Garden, Vertical farming

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BENEFITS OF INTEGRATING NATURE IN HEALTHCARE DESIGN

Mariam Oluwatosin and Adedoyin O. Babalola

Department of Architecture, University of Lagos, Nigeria

doyinbabalola@unilag.edu.ng

ABSTRACT

Considering the changes and challenges facing humanity, it is paramount for healthcare

systems to remain updated and meet current needs. The pandemic has exposed various gaps and show the need to promote a healthy environment and develop a sustainable healthcare system. The aim of this study is to highlight and contribute to the interventions and benefits of nature within the healthcare system and environment when properly integrated. This paper is a qualitative narrative review of existing literature and data derived from case studies integrating nature into healthcare design. The paper is able to highlight these benefits as well as the sustainable design considerations and how it enhances the environment in the healthcare facilities while increasing better health outcomes and recovery.

Key words: Design, Benefits, Environment, Healthcare, Nature

20C/ENV/006P

LAGOS ICT HUB: AN ECO-FRIENDLY APPROACH TO DESIGN OF INNOVATION SPACES

Olaoluwa A. Osundare and Adedoyin O. Babalola
Department of Architecture, University of Lagos, Nigeria
olaoluwaosundare@gmail.com

ABSTRACT

The United Nations Sustainable Development Target 7.1 is to ensure by 2030 there is a substantial increase in the share of affordable, reliable, and modern sustainable energy services. With South Africa, Kenya, Nigeria, Egypt, and Morocco having 50 percent of the tech hubs in Africa, Nigeria positions itself as a critical player in the age of innovation and technological advancement. The overbearing cost of energy consumption, unreliable power supply, lack of space flexibility, and the inability for current spaces to meet innovative technology development, plagues the efforts of creators and innovators from the optimum productivity required. This paper is hinged on integrating sustainable energy principles into innovation spaces while promoting flexibility, adaptability, diversity, and creativity through qualitative analysis of innovation spaces. The findings show that the multidimensionality of spaces is critical for different creation of technological solutions, the psychological impact of openness and feeling of space as well as the instilled interaction among co-innovators. It emphasizes that integration of nature and sustainable building materials can help optimize building energy efficiency.

Keywords: Eco-friendly, Energy efficiency, Flexible spaces, Innovation spaces, Tech-hubs

20C/ENV/007P

**THE CHANGING CULTURE OF LEARNING PLACES AND SPACES IN AFRICA:
A REVIEW OF POST COVID REALITIES TOWARDS ACHIEVING SAFE
LEARNING ENVIRONMENTS**

¹Oginni A.O. and ²Oyalowo B.

¹Department of Architecture, University of Lagos

²Department of Estate Management, University of Lagos.
oginniadeyemi@gmail.com, boyalowo@unilag.edu.ng.

ABSTRACT

Previous studies have established a relationship between comfort and productivity. Learning spaces in Nigeria have been grossly inadequate in comparison to the UNESCO education standards and now much more so with the advent of the global pandemic, COVID 19. Safety now ranks highest as the viral spread has paralysed all economic systems world over. In the bid to restore normalcy, a new restructuring must be put in place; regarding schools and education of children. For public municipalities, de-congestion is key. A paucity of research exists on the design of educational spaces, particularly for the primary school levels. A study sample of over 200 public schools showed that Overcrowding was recurrent in most of the classrooms. Thus, this research seeks to review various options available in flattening the curve as the society adapts to this new order, through architectural design, government policies and facility management. Options reviewed include scheduling of classes, virtual learning, the use of a blended curriculum and refurbishing, for an enabling environment. It concludes with recommendations to all stakeholders and the government to adopt the requisite systems suited to each locale, which will ensure continuity, safety and smooth running of the educational system. No singular option in this paper is sufficient in itself, but a combination of sorts, in facility management and architectural solutions; this can offer a respite in restoring the economy to the ‘new normal’, with respect to education.

Keywords; COVID 19, Sustainable classrooms, Education, Overcrowding, Learning, Africa

**ASSESSMENT OF BARRIERS HINDERING CONSTRUCTION PROFESSIONALS
IN ADOPTION OF SUSTAINABLE CONSTRUCTION IN THE NIGERIAN
CONSTRUCTION INDUSTRY**

¹Adeleke A.O., ²Eniolawun S.O. and ³Olaitan P.O.

¹Department of Building Technology, Moshood Abiola Polytechnic, Abeokuta

^{2,3}Department of Urban and Regional Planning, Lagos State Polytechnic, Ikorodu

ABSTRACT

This study aims at assessing the challenges and barriers in adoption of sustainable construction in the Nigerian construction industry with a view to value for money and a sustainable environment in project delivery. The study was conducted through a survey method and used questionnaires, interviews, observations for data collection. It also reviewed documented data from available records including journals and books. A total of 105 questionnaires semi-structured questionnaires were administered to various construction professionals in Lagos, Nigeria. Seventy-two (72) questionnaires were retrieved and carefully analysed with statistical package for social science (SPSS V.21). The study found that poor government support for sustainable construction posed a greater challenge to adoption of the concept with the lowest mean of 1.72. The study also reveals that investment in Green Building related research and financial incentives (e.g. Tax holidays, green loans etc.) was one of the fastest ways to promote uptake of green building concept. It is therefore recommended that the government should assume a greater role in the popularisation and application of sustainable strategy and should adopt the appropriate legislation related to the implementation of the strategy.

Keywords: Assessment, Sustainable, Green Construction, Barriers, Measures

**COVID-19, REAL ESTATE MARKETS, SHORT-RUN AND MID-RUN EFFECT
IN LAGOS MEGACITY**

¹Ogungbemi A.O., ²Kosofe R.A., ¹Akingbade O.H. and ³Obatuase B.

¹Department of Estate Management and Valuation, Lagos State Polytechnic, Ikorodu,

²Department of Urban and Regional Planning, Lagos State Polytechnic, Ikorodu,

³Department of Quantity Surveying, Lagos State Polytechnic, Ikorodu

hassanlanre88@gmail.com

ABSTRACT

The current global pandemic (called “COVID-19”) has caused a vivid decline in consumption, which leads to drop in prices, a decrease in workers’ per capita income, and resulted to an increase in unemployment, due to depress consumption. The real estate market, as an important factor of production, tends to move independently from the context of the above mentioned economic variables. The upshot of pandemics on housing markets is an unfamiliar topic in international literature, while the few specific studies existing found are reported and, through likeness. Subsequently, beginning from the real estate dynamics and economic indicators of Lagos megacity before the COVID-19 emergency, the current COVID-19 scenario is defined focusing on unemployment, personal and household income, property value, real estate dynamics in evaluating the short and mid-run COVID-19 effects on housing prices. The study found that there were potential changes in the mid-run on real estate dynamics, however, the property value prices drop of 2.04% in the short-run and 5.32% in the mid-run effects. The study further recommends some government intervention for real estate developer.

Keywords: COVID-19, Real Estate, Lagos Megacity, Pandemic, Property Value

20C/ENV/010P

**ANALYSIS OF WASTE COLLECTION IN LAGOS MEGACITY
AMIDST THE PANDEMIC**

Eniolawun S.O., Kosofe R.A. and Olaitan P.O.

Department of Urban and Regional Planning, Lagos State Polytechnic, Ikorodu

ABSTRACT

At this time, it is vital not to let speculative media commentary distract from the facts. COVID-19 is a serious issue and, effected all humanity on earth. This study examined solid waste collection amidst of the pandemic. A total of one hundred and thirty-two (132) questionnaires were administered to respondents' in the study area using random sampling method. The result of the finding found that significant proportion of respondents 65.1% building neglected during pandemic (lockdown period), lack sanitation facilities in their households, 67.9% of the respondents lack access to water within their households, 23.8% and 44% of the households' depend on unprotected dug well and water vendor (Aboki) as sources of water for their households, 23.2% lack access to kitchen space, 39.9% had poor drainage. The result of households' satisfaction index on sanitation facilities found that minority proportion of the households were satisfied and just satisfied, and substantial proportion of the respondents were not satisfied and not at all satisfied about the present state of sanitation facilities in the study area. The study advocates the need for cleaner and hygienic environment in the time of pandemic.

Keyword: Analysis, COVID-19, Waste, Collection, Lagos Megacity

20C/ENV/011P

**AN APPRAISAL OF THE LANDUSE CONVERSION IN COMPUTER VILLAGE
IKEJA, LAGOS STATE, NIGERIA**

Ojo Oladimeji Olusola

Urban and Regional Planning Department, Federal Polytechnic Ilaro, Ogun State, Nigeria
oladimeji.ojo@federalpolyilaro.edu.ng

ABSTRACT

Lagos metropolis as a commercial nerve centre of Nigeria accommodates more people than it capacity interim of space and employment. This has found expression in the indiscriminately

conversion of existing building from their original uses to meet the current demand of commercial activities. Recently, there are challenges relating to traffic congestion, environmental pollution and high cost in rent. However, the study carefully appraises the causes, process and effect of such conversion within computer village, Ikeja, Lagos State. The total number of 137 buildings were identified. All the buildings were included in the study and thus constitute the sample frame. The data collection instrument used was self-administered questionnaires. The questionnaires were in two sets, one for the occupants of buildings and the other for building owners or their agents/representatives. The streets constituting the study area are Adepele Street, Ola Ayeni Street, Oremeji Street, Oshintelu Street, Pepple Street and Otigba Street. Out of the 137 questionnaires distributed, 96 were recovered. The method of analysis is inferential which takes into consideration t-test for difference means. The results show that, there is increase in numbers of small shops, big shops and offices with H_{01} (t-stat -16.19930007, p-value 0.000 <5%), H_{02} (t-statistic -24.6, p-value 0.000 < 5%) and H_{03} (t-statistic -12.80730366, p-value 0.000 < 5%) respectively and thereby concludes that there is significant difference in the rent collected on small size shop, large size shop and office space before and after conversion. The study recommended that there should be adequate funding and equipment for development control unit to sufficiently carry out their daily activities and its implications should be known to the public.

Keywords: Appraisal; Process; effects; change of use; Illegal; computer Village

20C/ENV/012P

EFFECT OF PIPE PROPERTIES ON THE PERFORMANCE OF EARTH-AIR HEAT EXCHANGER (EAHE) SYSTEM FOR PASSIVE COOLING OF BUILDINGS: A REVIEW

***Olusegun Idris Salisu, John Oko Ameh and Koleola Tunwase Odusami**

Department of Building, University of Lagos, Akoka, 100213, Yaba, Lagos, Nigeria.

* salisusegzy@gmail.com

ABSTRACT

Globally, buildings use approximately 50% of the total world annual energy generated. Most of this energy are used for providing lighting, heating, cooling and air conditioning. An increase in awareness globally of the environmental impact of CO, NO_x and CFCs emissions

triggered a renewed interest in environmentally friendly cooling and heating technologies that comes at low energy cost. The aim of the study is to determine the effect of pipe properties on the performance of Earth-Air Heat Exchanger (EAHE) System for Passive Cooling of Buildings. Three research questions were used to achieve the aim of the study. The study adopted Meta-Analysis for data collection using previous studies from 2003- 2018. Meta-analysis is a statistical procedure (quantitative) usually randomised used to systematically assess data from multiple previous studies to derive conclusion about the body of research. Data collected from previous studies were analysed to form a detailed database knowledge on the optimisation of EAHE in terms of pipe length, pipe size and pipe diameter. The research findings revealed that for optimisation performance of EAHE system, pipe length of 30meters, pipe material of PVC, pipe size of 75mm are widely used in setting up an EAHE passive cooling system. The study concluded that for optimisation performance of EAHE system the widely used working parameters gives an efficient thermal performance of EAHE system for cooling.

Keywords: earth-to-air heat exchanger, pipe diameter, pipe length, pipe materials, thermal performance.

20C/ENV/013P

HOUSING ADEQUACY AND COVID-19 IMPACTS

¹Basirat Oyalowo, ²Taibat Lawanson, ³Mofelola Olayanju and ^{1*}Timothy Nubi

¹Department of Estate Management/Centre for Housing and Sustainable Development
University of Lagos.

²Department of Urban and Regional Planning/Centre for Housing and Sustainable
Development University of Lagos.

³Centre for Housing and Sustainable Development University of Lagos.
centreforhousing@unilag.edu.ng

ABSTRACT

The purpose of this study is to understand how housing adequacy affects the ability of households to protect themselves and their families from the COVID-19 Pandemic. The objective was to provide in-depth appraisal into the adequacy of peoples' homes as the crux of Public Health Measures and hence assess the effectiveness of COVID-19 Management in highly dense cities like Lagos. The study is based on a quantitative design with an on-line

survey carried out over a period of two weeks, between the 1st and 12th of April, 2020. Questions were raised with regards to extent of public awareness about COVID-19, adequacy of current habitation social and physical distancing and accessibility to preventive care for COVID-19 with specific reference to water, sanitation and hygiene (WASH) amongst others. Responses from the 453 respondents was analysed using Computer Aided Qualitative Analysis Software ATLAS ti-8. Findings revealed a high level of awareness of COVID-19, with 87.6% of respondents being aware of symptoms. Analysis showed a high rate of dependency on purchased water amongst households (35% of respondents), while the availability of self-isolation facilities such as spare rooms was low. The study also showed that residents of multi-tenanted housing that share toilet facilities do so with up to 10 other families. All these exacerbate the spread of COVID-19, coupled with the low level of local government participation and low level of community preparedness, that was reported by significant proportion of the respondents. It is recommended that community preparedness projects be carried in the short term to mitigate spread and in the long term, in-situ home improvement schemes be carried out to improve housing adequacy especially in the areas of water, sanitation and hygiene facilities. The study also recommends increased local government participation in COVID-19 management.

Keywords: Housing, COVID-19, Coronavirus, Housing Adequacy, WASH

20C/ENV/014P

COVID-19 AND PRINT MEDIA ACCOUNTS OF SUSTAINABILITY ISSUES IN NIGERIA'S HOUSING SECTOR

Basirat Oyalowo

Department of Estate Management/Centre for Housing and Sustainable Development
University of Lagos.
boyalow@unilag.edu.ng

ABSTRACT

This study provides an analysis of the housing sustainability issues reported in Nigeria's print media as a means of ascertaining areas of concern that require urgent policy action. The broad question guiding the study is: What are the housing sustainability issues reported in national newspapers over the four-month period before the COVID-19 pandemic in Nigeria, during the lockdown and immediately after? This question will enable an assessment of the prevailing trends in sustainability in Nigeria's housing sector, the possible issues that

COVID-19 news coverage might have displaced and the possibilities for policy, practice and knowledge impacts. A qualitative design was adopted for the research, with the use of content analysis of newspapers available online. Analysis of articles was carried out through computer aided qualitative analysis software, Atlas ti.8. With regards to sustainability issues, it was found that newspaper reports centred around the themes: climate, environment and government throughout the 4month period. However, while there was attention to biodiversity and waste in the Pre-COVID-19 period, the focus changed slightly to concerns about environmental impact (and influence) of the pandemic during the lockdown period and then to activities of government environmental agencies immediately after the lockdown. Housing issues during the three periods centred on the need for affordable housing, while economic sustainability of the real estate sector was a major concern thereafter. It is concluded that environmental impacts of human activities and housing affordability were still prioritised in media accounts thereby strengthening the need for continual policy action, while the lockdown provided an opportunity for the reappraisal of the economic sustainability of residential investments.

Keywords: COVID-19, Housing Sustainability, Lockdown, Newspaper research

20C/ENV/015P

ADEQUACY OF VEHICULAR TRAFFIC INFRASTRUCTURE ON SELECTED ROADS IN LAGOS, NIGERIA

***Agunloye O.O. and Obabiyi A.A.**

Department of Urban and Regional Planning,
University of Lagos, Akoka, Yaba, Lagos State, Nigeria.
*ooagunloye@gmail.com, obabiyiaishah@gmail.com

ABSTRACT

This study presents users' opinion on the adequacy of vehicular traffic infrastructure of selected roads (Lagos- Ikorodu Road, Lekki-Epe Road and Lagos-Badagry Road) with a view to suggesting policy-focused recommendations, which when adequately implemented will lead to an improvement in the present conditions of road traffic infrastructure in Lagos, Nigeria. Data were primarily sourced through questionnaire administration on commuters. Commuters were purposively selected from a total number of 145,583 commuters in order to attain a sample size of 27% which represents the total number of questionnaire (399) administered for the study. Data collection was through the administration of structured

questionnaire on users' perception of adequate vehicular traffic infrastructure. The data were analysed using descriptive (frequency table, Likert scale, cross tabulation), and inferential (factor analysis and locational quotient) statistical tools. The study revealed that 50.9% of commuters assessed the adequacy of the traffic infrastructure as moderately adequate. The adequacy of road infrastructure was examined using Locational Quotient (LQ) and found that most of the infrastructure is inadequate. The study also revealed that traffic infrastructure such as paved driveway, road signage, terminals, overhead bridge had a Commuters Perception Index (CPI) mean value of 3.69. The study concluded by recommending measures that could enhance the quality of road traffic infrastructure which includes provision of an inclusive road traffic infrastructure, supporting compact land uses, provision of safe, convenient and efficient mass transit system across all major roads around the city and proactive adequate and efficient maintenance exercise.

Keywords: Transportation, Adequacy, Road Infrastructure

20C/ENV/016P

**AN EVALUATION OF THE BEHAVIOURAL ATTITUDE OF STUDENTS
TOWARDS SUSTAINABLE WASTE MANAGEMENT IN THE UNIVERSITY OF
LAGOS**

Kolawole O.M, Oginni A.O. and Teye A.T.

Department of Architecture, Faculty of Environmental Science, University of Lagos.
kolawoleoluwatola@gmail.com, aoginni@unilag.edu.ng, adefolatoye@gmail.com

ABSTRACT

This study focuses on the behavioural attitude of students towards sustainable waste management in creating a sustainable community in the University of Lagos. It reveals the approach of users specifically students of the university to waste sorting, use of waste disposal facilities and the implication of this on the sustainable waste management process. Data sources for this study were questionnaires administered to the students of the University of Lagos and unstructured interviews with staff of the university's Waste Sorting Centre. 104 responses were obtained from the questionnaire using simple random sampling method. Data was collected through computerized self-administered questionnaires on Google Form and analysed using Microsoft Excel software. Data was presented through frequency distribution

and percentages. Results showed that more than half of the students interviewed had a good behavioural attitude towards waste sorting and use of waste disposal facilities. 66% showed good knowledge of waste sorting and 58% actually practiced waste sorting. It was also revealed that there was a considerable level of dissatisfaction with the current waste management process in the university particularly on the poor condition of waste bins, the inefficiency of current practices and lack of practice by users. The feedback from this study will enable the implementation of engaging and sustainable green policies and practices geared towards not only sustainable waste management but also towards environmental preservation and combating climate change in the university.

Keywords: Sustainable University, Waste Management, Behavioural Attitudes, Climate Change.

20C/ ENV/017P

**ASSESSMENT OF SOIL EROSION SUSCEPTIBILITY OF THE IMO RIVER BASIN
USING MORPHOMETRY-BASED ANALYSIS: A REMOTE SENSING AND GIS
APPROACH**

**Peter C. Nwilo, Caleb O. Ogbeta*, Olagoke E. Daramola, Chukwuma J. Okolie and
Michael J. Orji**

Department of Surveying and Geoinformatics, University of Lagos, Lagos, Nigeria

* ogbetac@gmail.com

ABSTRACT

Gullies and other types of erosion have been the biggest environmental issue and disaster in South-Eastern Nigeria. The challenge presented by soil erosion in this region has threatened agricultural production, biodiversity for the ecosystem and food health. This has also reduced land resources for agricultural production and urban growth. In order to guide intervention measures, it is necessary to identify vulnerable areas to soil erosion in this region. This research demonstrates the use of watershed morphometry combined with weighted sum analysis (WSA) to estimate the susceptibility of soil erosion of sub-watersheds of the Imo River Basin in South-Eastern Nigeria using satellite-based remote sensing data and geographic information system (GIS) analysis. To this end, 18 morphometric parameters including basic, linear, shape, and relief were extracted and analyzed using the Shuttle Radar Topography Mission (SRTM), a Digital Elevation Model with 30 m spatial resolution. The

method of receiver operating characteristics (ROC) curves was used to validate the model's prediction accuracy. This morphometry-based analysis resulted in the sub-watersheds being classified into regions of low, medium, high and very high erosion susceptibility. With regard to erosion susceptibility, 41.51% of the basin area (2494,68 km²) are in the very high priority region; while 10.50%, 44.33%, and 3.66% of the basin are in high, medium, and low priority regions respectively. Validation of the final erosion susceptibility map showed a prediction accuracy of 81%. The findings of this study serve as a knowledge resource to inform sustainable watershed management practices aimed at soil erosion mitigation in the region.

Keywords: Morphometry, weighted sum analysis, erosion susceptibility, Remote sensing

20C/ ENV/018P

TEMPORAL ANALYSIS OF CHANGES IN POSITIONAL ACCURACY OF GOOGLEEARTH HISTORICAL IMAGERY DATA

**¹Nwilo P.C., ^{1*}Okolie C.J., ^{1,3}Ayoade Q., ¹Onyegbula J.C., ¹Daramola O.E., ¹Orji M.J.,
²Arungwa I.D. and ¹Uyo I.I.**

¹Department of Surveying and Geoinformatics, University of Lagos, Lagos State, Nigeria.

²Department of Surveying and Geoinformatics, Abia State University, Abia State, Nigeria.

³Ogun State Surveyor General's Office, Ogun State, Nigeria.

* cokolie@unilag.edu.ng

ABSTRACT

Google Earth is a computer program that renders a three-dimensional (3D) representation of the Earth based primarily on satellite imagery. In version 5.0, Google introduced 'Historical Imagery', a tool that allows users to view imageries at different epochs. In this study, the positional accuracy of Google Earth historical imageries is investigated within Lagos, Nigeria for the following periods: 2000, 2008, 2012 and 2018. The horizontal accuracies were assessed by comparing X and Y coordinates from Google Earth with validation points on an orthophoto. The vertical accuracy at a single epoch was assessed by comparing 556 elevation points sourced from Google Earth with ground control points and readily available Global Digital Elevation Models (DEMs) like the 1 arc-second SRTM v3 and AW3D v 2.1. In the historical imagery analysis, the standard deviations (SDs) and root mean square errors (RMSEs) in the x-direction were as follows: 2000 (SD: 4.97m, RMSE: 9.52m), 2008 (SD: 4.83m, 14.04m), 2012 (SD: 4.34m, RMSE: 15.97m) and 2018 (SD: 3.71m, RMSE: 3.72m).

In the y-direction, the SDs and RMSEs were as follows: 2000 (SD: 4.36m, RMSE: 4.93m), 2008 (SD: 3.54m, 3.65m), 2012 (SD: 1.48m, RMSE: 4.39m) and 2018 (SD: 3.66m, RMSE: 4.28m). Analysis of the horizontal shift shows that the 2018 imagery was the most accurate (SD: 2.54m, RMSE: 6.13m) while the 2000 imagery was the least accurate (SD: 5.05m, RMSE: 16.97m). In terms of the vertical accuracy, the analysis yielded an SD and RMSE with similar value of 6.19m. It was shown that the vertical accuracies of SRTM v3 and AW3D v 2.1 outperformed the elevations sourced from Google Earth. These findings are important to inform end-users of the reliability of Google Earth historical imageries and elevation data for conducting time-dependent studies and change detection assessments.

Keywords: Google Earth, Historical Imagery, Orthophoto, Digital Elevation Model, Accuracy

20C/ ENV/019P

INUNDATION MAPPING OF RIVER OGUN, SOUTH-WEST NIGERIA

Nwilo P.C., Osaigbevo A.O., *Okolie C.J., Daramola O.E. and Orji M.J.

Department of Surveying and Geoinformatics, University of Lagos, Lagos State, Nigeria.

* cokolie@unilag.edu.ng

ABSTRACT

In Nigeria, flooding is an occurrence with wide-ranging impacts. The worst flooding in recent history occurred in 2012 in which more than 2.3 million people were displaced and 363 lives were lost. Sixteen million people were impacted in various ways, infrastructures were destroyed and total losses were estimated at US\$16.9 billion. In this study, we investigated flood-prone areas along the flood plains of River Ogun in southwest Nigeria. The occurrence of flooding in the southwest poses a threat to its people as well as infrastructures on a yearly basis. The flood modelling was based on the flow rates of different return periods using land cover data, HEC-RAS model for simulations, and HEC-GeoRAS for model visualisation. Sentinel-2A satellite imagery was acquired, preprocessed and classified using the neural network classifier in ENVI 5.3 remote sensing software. The land cover data was fed into HEC-RAS where simulations were carried out for 5, 10, 25, 50 and 100- year return periods. This yielded their respective annual exceedance probability (AEP)- the probability of such flood magnitude occurring in a given year. In addition, flood maps showing the spatial extent for 5 and 100-year floods were prepared. The results show that to reduce the adverse effects

of flooding especially in the low-lying flood prone areas, proper flood management should be adopted. The use of 100-year flood maps is recommended as risk base maps for flood insurance in line with the practice in other climes.

Keywords: Flooding, Flood Maps, Neural Network, Remote Sensing, River Ogun

20C/ENV/020P

CARBONATION OF CONCRETE CURED UNDER DIFFERENT CONDITIONS

***Kolawole Adisa Olonade and Nafisah Motunrayo Akinniyi**

Department of Civil and Environmental Engineering, University of Lagos, Lagos, Nigeria

* kolonade@unilag.edu.ng

ABSTRACT

Carbonation of concrete is deteriorating phenomenon aggravated by emission of carbon-dioxide (CO_2) into the atmosphere. Curing of fresh concrete till hardened state on the other hand influences the extent to which the hardened concrete is attacked by carbonation, while curing techniques have different effect on the hardened properties of concrete mix. In this study, effect of different curing techniques on the carbonation depth of concrete mix is presented. Concrete matrix of mix ratio 1:2:4 with water cement ratio of 0.5 was prepared and cast into cubes of sizes 150 mm. After 24 hours, the concrete cubes were removed from steel moulds and cured in different media for 3, 7, 28, 56, 91, 140, 183 and 365 days. The curing techniques investigated were immersion in water (IM), sprinkling (SP), polyethylene membrane (PM), damp sand (DS), indoor (OI), outdoor (OT) and saturated wet covering (SWC). Thereafter, compressive strength of the concrete cubes and carbonation depths were determined at the end of each curing day. Average of three readings was recorded as strength, while average of 10 readings was measured for carbonation depth. The results indicated that carbonation depth differed with each of the concrete cured in different techniques. It was observed that concrete exposed outside was worst affected by carbonation followed by those cured indoor, while those cured with polythene showed least carbonation depth. It was concluded that polythene membrane curing technique was the best curing technique to limit effect of carbonation of concrete.

Keywords: carbonation depth, curing techniques, permeability and compressive strength

EFFECT OF RISK MANAGEMENT ON BANK PERFORMANCE

¹Agunobi Chigosimuzo and ²Nwude Chuke

agunobigosim@gmail.com;chukwunekenwude@yahoo.com

ABSTRACT

Risk management issues in the banking sector do not only have great impact on bank performance but also on national economic growth. The banks' motivation of risk management comes from those risks which can lead to underperformance. This study focuses on risk management practice and its effect on bank performance in Nigeria. Secondary data sourced was based on 16 years (2000 – 2015) progressive annual reports and financial statements of the Central Bank of Nigeria, Nigerian Deposit Insurance Commission and the World Bank Index Report. Return on Average Asset (ROAA) was adopted as proxy for Bank Performance which represents the Dependent variable. However, Risk management was divided into two major risk; Credit risk and Operational risk. Macroeconomic variables; Annual Percent Change in GDP (GDPC) and Annual Percent Change in Inflation (INF) which were also introduced into the model as proxies for Credit and Operational risk. Corruption Index (CPI) was adopted as a dummy variable. The regression analysis result displays coefficient of GDPC at 3.56 with a P-value of 0.61 while INF coefficient and P-value stands at 2.65 and 0.06 respectively. These values indicate a positive correlation of each variable on the dependent variable. CPI also had a positive coefficient of 1.55 with P-value of 0.75. Correspondingly, the percentage of the variance explained by the independent variables (R^2) stands at 0.89 (89%), this point to a strong relationship of both the independent variables and the dependent variable. In concise, this research result established a strong positive correlation of credit risk and operational risk on bank performance. Hence the crucial importance of risk management in the banking sector.

Keywords: Bank performance, Risk Management, Economic growth, Gross Domestic Product, Inflation

**TECHNOLOGY DIFFUSION AS THERAPEUTIC PRESCRIPTION FOR
IMPROVED PERFORMANCE IN THE AILING NIGERIAN INSURANCE
INDUSTRY**

Adebisi S.A., Kuye O.L. and *Ehiorobo Osa Abraham

Department of Business Administration, University of Lagos, Nigeria.

*newdawnabraham@yahoo.com

ABSTRACT

Organisations worldwide rely on their resource capabilities to excel in the competitive arena. Such crucial resources may include financial, physical, human, knowledge, technological and general organizational resources. This study attempts to identify how the insurance companies in Nigeria can diffuse technology in their operations to improve overall industry performance. The Nigerian insurance industry is lagging behind in technology diffusion and this can, perhaps, explain the low level of performance that currently characterises the sector. With the global drift towards the use of artificial intelligence and other technological innovations, businesses worldwide are adopting technology-enabled strategies to drive operations, serve customers better and achieve competitive supremacy over rivals. This research is a quantitative design based on the positivist philosophy with an ontological orientation of objectivism and anchored on the Diffusion of Innovation Theory. The study utilises a cross-sectional survey research strategy and used multiple regression analysis for data. Findings from the study reveal that the insurance sector in Nigeria has not embraced artificial intelligence and their level of adoption of other forms of information technology is very low. It is hereby recommended that managers of insurance companies should invest in, train their staff on, and adopt AI and other information technology tools in order to enhance their performance.

Keywords: Diffusion, competition, artificial intelligence, strategy, technology.

HOW EFFICIENT INTEGRATED COORDINATION IN CRISIS MANAGEMENT SAVED NIGERIA FROM COVID-19

Buoye P.A. and Alawode A.J.

Computer Science Department, Federal Polytechnic, Ilaro
adewuyi.buoye@federalpolyilaro.edu.ng; john.alawode@federalpolyilaro.edu.ng

ABSTRACT

This paper examined the effect of efficient integrated coordination in crisis management in the spread of COVID-19 in Nigeria. Secondary data, which were collected from the website of Nigeria Centre for Disease Control and Worldometer were used to analyse the number of covid-19 cases recorded after 134 days in Nigeria and Brazil. Four independent variables were considered which are; population, number of sample test, temperature and early lockdown policy in both Nigeria and Brazil. Correlation and regression techniques were used to analyse the data. The result shows that the effect of temperature is not significant on the dependent variable (number of cases) with $p > 0.08$ in the two countries. Analysis also shows that the ratio of sample test in Brazil to Nigeria was not significant enough (18:1) when compared to what was determined from the bivariate model of the two countries (409:1). Lockdown policy, which is a dummy variable (classification variable), gave a $p > 0.0001$, this is p value for a one-tailed t-test and means that there is a .01% probability. This p value is clearly less than 0.005 cut off, and indicates a statistically significant difference in the “direction” of our hypothesis. The paper concluded that early lockdown policy which is a part of integrated coordination in crisis management was responsible for the low confirmed cases of COVID-19 recorded in Nigeria.

Keywords: Corona virus, population, Temperature, Government policy, pandemic.

**IMPACT OF FEASIBILITY STUDY ON BUSINESS VENTURE: EVIDENCE FROM
COMPUTER VILLAGE BUSINESS CENTRE IKEJA LAGOS NIGERIA**

Lawal K.A. and Awin D.O.

Department of Entrepreneurship and Business Management,
National Open University of Nigeria.
klawal@noun.edu.ng; awindickson@gmail.com

ABSTRACT

The study focuses on the impact of feasibility analysis on business venture. It specifically evaluated the relationship between feasibility analysis, the growth of new ventures and their success. Most newly created business ventures in Nigeria do not perform up to expectations despite initial enthusiasm. Some hardly survive first year of operation why others could not grow above break-even level. One will wonder if such ventures actually conducted feasibility analysis before emergence. This created the problem of external funding as venture capitalists are uninterested in business with low potentials for growth. The study adopted a survey approach which employed both descriptive and exploratory methods of data analysis. Questionnaires were distributed and collected at the computer village business area Ikeja, Lagos. 350 respondents were purposefully chosen for the administration of the questionnaire and 300 completed responses were completed and returned for the study. Data were analyzed using frequency distribution table, percentage and regression technique with the aid of Statistical Package for Social Science. Using business years of experience as a predictor, the study found feasibility analysis conducted by entrepreneurs with longer business years of experience with a Beta value of 0.161 and alpha value of .005 which is lesser than 0.50 level of significant. This indicates that there is a significant relationship between business years of experience and the success of business ventures. The reason for this could be that the higher the years of experience the better business feasibility study may be conducted before starting the venture. New business ventures indeed require extensive feasibility study to reveal the business strength, weakness, opportunity and threat. The study advises intending entrepreneurs and managers who intends to expound operation to conduct extensive feasibility analysis at every stage of the business, to avoid obstacles that could hinder operation due to the dynamic and unstable environment of business.

Keywords: Business, Feasibility analysis, and Venture creation

20C/FMS/005P

AN EMPIRICAL REVIEW OF TWO INSTRUMENTS FOR GREEN POST-COVID-19 RECOVERY IN NIGERIA

Oluwaseun James Oguntuase^{ac*} and Adedayo Oluyemi Ajibare^{bc}

^aZenith Bank Plc; ^bAccess Bank Plc; ^cLagos State University, Nigeria

ABSTRACT

COVID-19 is as contagious economically as it is medically. It has negatively impacted several households, businesses and countries, raising the financial burden of governments worldwide. The essential rebuilding of economies will need huge financial outlays, far beyond the scarce public resources in Nigeria. Furthermore, concomitant with the announcement of policy measures to respond to the COVID-19 pandemic, there have been growing calls to ensure that such measures integrate responses to climate change. In this paper, we examine the concept of labeled bond and green quantitative easing as investment vehicles for mobilising private finance for post-COVID-19 recovery in Nigeria. Our choice is influenced by: the fact that they are low risk instruments for attracting funding from a wide range of investors over a long tenor; the pressurized public budgets in Nigeria; and the increasing impact of climate change in the country. The paper employs a systematic literature review approach in obtaining information that addresses the research objectives. Findings show the crucial roles of COVID-19 response bonds and green quantitative easing in facilitating post-COVID-19 recovery around the world. The paper concludes that these innovative financial instruments could help mobilise private finance at the scale required to achieve both green post-COVID-19 recovery and mitigate climate change in Nigeria. The paper ultimately recommended that sustainable green recovery must be central in the responses to the COVID-19 pandemic in Nigeria.

Keywords: Coronavirus, Climate change, Green recovery, Low-carbon economy, Sustainable finance

**EFFECT OF CORONAVIRUS DISEASE 2019 ON THE PERFORMANCE OF
EMPLOYEES IN NATIONAL HOSPITAL ABUJA, NIGERIA**

¹Ahmed, Aliyu Tanko, ²Aliyu, Hassan Isiaka and ³Abdulkarim, Riskatu Isyaku

¹Department of Business Administration & Management,

²Department of Humanities and Social Science,

³Department of Estate Management & Valuation,

Federal Polytechnic, Nasarawa, Nasarawa State – Nigeria.

babanmusa170@gmail.com; isiaka93@gmail.com; askrisi@yahoo.co.uk

ABSTRACT

Employees are expected to improve the general wellbeing of organization but coronavirus disease 2019 (COVID-19) has changed the way everything is done in the organisation today. This has led to sudden rise in the demand of medical and non-medical personnel to limit the spread of the virus. The objective of the study is to investigate the effect of COVID-19 on performance of employees in National Hospital, Abuja. Data was collected using a well structure questionnaire which was analysed using descriptive statistics and regression analysis to test the formulated hypotheses with the aid of statistical package for social sciences (SPSS) version 22 for analysis of data. A population of 2,500 employees and a sample of 345 respondents were drawn using Yamane's (1967) simplified formulae. The findings showed that COVID-19 has destabilised the activities of employees in National Hospital, Abuja. The study concluded that COVID-19 pandemic affects the performance of employees in National Hospital, Abuja. In light of these, the study recommended that Governments should modify their strategy on the awareness campaign to educate the public on coronavirus disease 2019, seminars and workshops should be organised for employees on survival strategy during and after COVID-19 pandemic.

Keywords: coronavirus disease 2019, employee, performance, lock-down, pandemic.

**COVID-19 AND PERFORMANCE OF SMES IN OGUN STATE: A STUDY OF
SELECTED SMES IN ILARO YEWA SOUTH DISTRICT**

Amusan O.M.*, Taiwo A.A. and Omojaro A.O.

Department of Business Administration and Management, Federal Polytechnic, Ilaro, Ogun
State

oluwaseun.amusan@federalpolyilaro.edu.ng; omojaroanthony@gmail.com;

*akeem.taiwo@federalpolyilaro.edu.ng

ABSTRACT

The study was carried out to investigate the impact of the COVID-19 global pandemic on the performance of SMEs in Ilaro Yewa South district of Ogun State, Nigeria. A descriptive survey design was adopted which involved the administration of a structured questionnaire on staff of selected SMEs in the area. This study takes a sample of fifty (50) SMEs that cuts across four different sectors i.e. agriculture, consumer goods, services and ICT using a convenience sampling technique. The basis for selecting 50 SMEs for the study is borne out of their proximity to the researcher which could facilitate data collection. A structured questionnaire was adopted as the data collection instrument. The questionnaire was validated using expert opinion on the contents of the instrument while the reliability test was conducted using Cronbach alpha's test to ascertain the internal consistency of the variables under study. The collected data were analysed using descriptive statistics and the hypotheses were tested using non-parametric analysis (Mann-Whitney U-test) via the Statistical Package for Social Sciences (SPSS) version 20. The findings of the study revealed that COVID-19 is statistically significant in causing a change in supply chain ($p < 0.000$) and sales turnover ($p < 0.000$). Based on the findings, it was recommended among others that government should provide incentives to SMEs who have been hit badly by the pandemic in the form of relief loans

Keywords: COVID-19, SMEs, Supply chain, Sales turnover, Pandemic

**EFFECT OF POPULATION GROWTH ON ECONOMIC GROWTH IN NIGERIA
FROM 2010 TO 2015**

Atobatele Abolaji Jamiu

Department of Public Administration, Faculty of Administration,
Ahmadu Bello University, Zaria.
abolaji561@gmail.com

ABSTRACT

The importance of population growth to the development of any country cannot be over-emphasised, most especially when it is equilibrium with developed resources coupled with good management skills. Nigeria is a country endowed with enormous natural and human resources such as crude oil, good arable land for agriculture, ready-made market for commercialisation. The country is adjudged the most populous in Sub-Sahara Africa and Seventh most populous in the world. However, Nigeria is expected to be one of the fastest and best economies in the world vis-à-vis the resources that are embedded in the country but the corruption and bad leadership in the country are mitigating against her development thereby leading to over utilisation of few available resources. Hence population grows faster than the available resources which led to increase in the incidence of unemployment, poverty, insecurity etc. It is against this backdrop that this study seeks to examine the effect of population growth on economic growth in Nigeria. This study used secondary source and time series data for the period of 2010 to 2015 and adopted OLS Regression technique to analyse its data. The result indicated that population has a positive effect on economic growth. The study therefore recommended that government should explore the resources endowed the country and invest heavily on education.

Keywords: Population Growth, Development, Nigeria, Government, Economic Growth

**BRAND AWARENESS AND CONSUMER PATRONAGE: A STUDY OF NESTLE
PLC PRODUCTS IN ILARO, OGUN STATE**

¹*Abiaziem, Fortune Ugochukwu and ²Adebanjo, Oludotun Adewale

¹Department of Marketing, The Federal Polytechnic Ilaro, Ogun State, Nigeria.

²Department of Marketing, The Gateway (ICT) Polytechnic, Saapade, Ogun State.

* brandfortifiers@yahoo.com

ABSTRACT

This study examined the influence of brand awareness on consumer patronage of Nestle Plc products in Ilaro, Ogun State. As a result of increasing competition amongst Fast Moving Commodity Companies (FMCGs), brand awareness becomes inevitable as an effective tool to deliver premium customer value. The objectives of the study were to determine the significant influence of brand personality, brand reliability and trade mark on consumer patronage. The researchers employed descriptive research design because they intend to compare consumers' attitudinal behaviour regarding brand awareness. The population of the study comprised all the 26 distributors/ wholesalers and the entire consumers of the company in Ilaro. Data were collected via self-administered questionnaire using Likert five point's scale. A sample size of 100 respondents derived from Cochran's sample size formula ($S = z^2 pq / e^2$) of infinite population at 5% precision was used. Stratified random sampling technique was used to capture different segments of the population while Cronbach Alpha reliability test was done to affirm the reliability of the research instrument with an average of 0.844 which is considered high. Data were analysed with the use of frequency tables while hypotheses were tested using Multiple Regression Analysis (OLS) with the aid of SPSS. The findings revealed that there exists strong positive relationship ($r = 0.769$) between joint effect of brand personality, brand reliability, trade mark, and consumer patronage. The sum of square (r) = (478.127 and mean square of (r) = 159.376 while sum of square and mean square for residual are 330.673 and 8.065 respectively with an F-value of 19.761 and p-value < 5% significance level. Conclusively, Brand Personality, Reliability and Trademark have significant effect on Consumer Patronage. The researchers therefore recommended that the company should constantly engage brand ambassadors and maintain their quality to sustain reliability of their brands while paying slightly less attention to trademark.

Keywords: Brand awareness, Brand personality, Brand reliability, Trademark, Consumer Patronage.

**INNOVATIVE MANAGEMENT AND BUSINESS OPERATION:
A STUDY OF LAFARGE NIGERIA PLC, EWEKORO**

***Ogunsanwo O. Abayomi and Kazeem A. Gbenga**

¹Department of Business Administration and Management, Federal Polytechnic, Ilaro

*abayomi.ogunsanwo@federalpolyilaro.edu.ng, gbenga.kazeem@federalpolyilaro.edu.ng

ABSTRACT

This paper principally focused on innovative management and its impact on business operation as management of innovation has been described essential for product and process development. Survey research design was adopted for this study, the population for this study were managerial staff of Lafarge Nigeria Plc Ewekoro, with the population of two thousand five hundred (2500) members of staff. The psychometric properties (reliability and validity) of the instrument used for this study were tested using cronbach alpha statistics and component factor analysis respectively. A sample of two hundred and fifty (250) respondents was selected using stratified sampling techniques. The data collected were analysed with descriptive and inferential statistics. While hypotheses formulated were tested using multiple regression method with the aid of SPSS. The findings of the study showed that thorough management of innovative ideas will help to achieve product and process innovation which will give the organisation advantage over their competitors. The results of the study also revealed that there was a strong positive relationship among innovative management, business operation and product innovation; this is evident by the result of the analyses $R^2=.702$ with associated significant value of $P<.001$. The study recommended that every organization must ensure that efforts are geared towards encouraging employees to come up with ideas that are innovative in nature and that could bring about product and process innovation.

Keywords: business operation, innovative management, process innovation, product innovation

20C/FMS/011P

**ASSESSMENT OF OGUN STATE AGRICULTURAL DEVELOPMENT
PROGRAMME (OGADEP) AND ITS EFFORT TOWARDS FOOD SECURITY**

Atobatele Abolaji Jamiu

Department of Public Administration, Faculty of Administration,
Ahmadu Bello University, Zaria
abolaji561@gmail.com

ABSTRACT

Ogun State Agricultural Development Programme was established in 1986 with an emphasis on the need to ensure food security in the state through implementation of On-farm adaptive research, etc. Despite this strategy initiated by OGADEP to enhance food production in the state, OGADEP contributions to food production is still at low ebb. It is against this backdrop that this study seeks to examine the contribution of On-Farm Adaptive Research to food security in Ogun State. This study used time series data for the period of 2010 to 2015 and adopted Partial Least Square Regression Technique because it is more robust and take care of uncertainties. The result indicated that OGADEP On Farm Adaptive Research has not enhanced food security in Ogun State. The study therefore recommended that government should give maximum attention to research by releasing necessary funds and ensure that resources committed to agriculture are adequately spent on agriculture.

Keywords: Agriculture, Development, Nigeria, Ogun State, OGADEP

20C/FMS/012P

**EXPLORING THE POTENTIALS OF E-LEARNING IN ACTUALIZING
INNOVATIVE LITERACY IN NIGERIAN TERTIARY INSTITUTIONS THROUGH
AND BEYOND THE COVID-19 PANDEMIC**

***Zakka, Daniel Dazan, Bewaran, Yongsun Shikfu and Moris, Priscilla Wetnwan**

Department of Office Technology and Management, Plateau State Polytechnic, Barkin Ladi
*zakkaddazan@gmail.com

ABSTRACT

The outbreak of COVID-19 led to the disruption of traditional face to face lectures in Nigeria's tertiary institutions, due to the closure of schools on March 19th 2020. The closure of schools was among several measures adopted by the Federal and State Governments to curtail the spread of COVID-19 in the country. This inevitably affected the higher

educational system in Nigeria, resulting in learning disruptions, decreased access to education and research facilities, disruption of academic calendars, postponement of examinations and project defenses and so on. The pandemic disruption further revealed the emerging vulnerabilities and crisis in the Nigerian educational system. It is against this backdrop that the study examined the potentials of e-learning in actualising innovative literacy in Nigerian tertiary institutions through and beyond the COVID-19 Pandemic, with a view to identifying innovative solutions to optimise educational endeavours that will cushion the effects of the pandemic on the education sector. The study conceptualised e-learning and innovative literacy. The study further examined the e-learning technologies and platforms for innovative literacy, potentials of e-learning for innovative literacy and the challenges of integrating e-learning in to the Nigerian tertiary education system. The study is an opinion or additional knowledge paper in which related literatures were reviewed and inferences drawn. The study concluded that the COVID-19 pandemic has necessitated the need for extraordinary solutions and alternative for teaching and learning in Nigeria's tertiary institutions. Stakeholders in the tertiary education system therefore need to explore how this emerging reality could usher in a new education architecture that can tackle the crisis caused by the pandemic. The study recommended that government and other stakeholders should improve funding for the provision of adequate ICT infrastructure and resources for e-learning.

Key words: Electronic Learning; Innovative Literacy; Tertiary Institutions; COVID-19 and Pandemic

20C/FMS/013P

**CORONA VIRUS PANDEMIC: A BANE TO NATIONAL DEVELOPMENT
(A STUDY OF SOME RESIDENTS OF ILARO METROPOLIS IN OGUN STATE,
NIGERIA)**

Bankole Oluseun Ayodele and Akinroluyo Bankole Isaac

Department of Business Administration and Management, Federal Polytechnic, Ilaro
bseun10@gmail.com;bankyroluyo@yahoo.com

ABSTRACT

The COVID-19 is most recently discovered of the corona viruses which caused respiratory infections consisting of two large scale pandemics MERS & SARS and found to be zoonotic in origin. This study determined effect of inadequate treatment and vaccine on consumption per capital and identified impact of COVID-19 transmission route on literacy rate. The study

is an empirical investigation conducted through a self-administered survey questionnaire which was used to elicit information from the residents of Ilaro metropolis, Ilaro Ogun State. Data obtained from survey were analysed and presented through the use of ordinary least regression inferential statistical technique. Findings from the study revealed that; corona virus pandemic is a function of lack of adequate treatment and vaccine on consumption per capital ($R = 0.643$, $R_2 = 0.413$, $P < .05$). Also, impact of COVID-19 transmission route is a function of literacy rate ($R = 0.641$, $R_2 = 0.411$, $P < .05$). The study concluded that adequate treatment and vaccine for COVID-19 pandemic will help the consumption per capital of any economy and also reduce the death rate. The study therefore recommended that Nigeria most importantly Ilaro metropolis in Ogun State needs to provide adequate treatment and vaccine that will help curtail the spread of COVID-19 pandemic and also to take cognisance of the transmission route.

Keywords: Corona Virus Pandemic, national development, transmission route, economy

20C/FMS/014P

CORONA VIRUS (COVID-19) AND THE SURVIVAL OF SMALL AND MEDIUM ENTERPRISES IN SANGO OTTA, OGUN STATE NIGERIA

¹Yusuf Adebola Bako, ¹Oluwaseun John Olopade and ²Zainab Funke Bako

¹Department of Business Administration and Management, The Federal polytechnic Ilaro

²Department of Marketing, The Federal Polytechnic Ilaro, Ogun State Nigeria.

yusuf.bako@federalpolyilaro.edu.ng; johnoluwaseun315@gmail.com

ABSTRACT

This study assessed the relationship between COVID-19 and the survival of Small and Medium Enterprises. The survey research design was employed in carrying out the study and SMEs owners in Sango otta, Ogun State, Nigeria constituted the population with a total of two hundred and sixty-one (261) SMES. The study used the Yamane formula for calculating the sample size of 158 out of 261 registered SMEs at the Ifo Local Government through the Corporate Affairs Commission (CAC). Data for the study were collected using a standardised questionnaire and the collected data were analysed using inferential statistics (regression analysis and correlation analysis). The result of the analysis unveiled those COVID19- sub-variables (lockdown days, internal movement restriction and international travel restriction, with Beta value of ($\beta = -412$, $\beta = -281$ and $\beta = -044$) all have significant negative relationship with the survival of SME businesses. The ANOVA which assess the overall significance of our model reports indicates an F-statistic of 12.369 with a probability value of 0.00000. Since the probability value of our model is less than the critical values of both 0.01 and 0.05, it

implies that the model is significant at both 1% and 5% level of significance and we can reasonably inferred that COVID-19 has a significant effect on survival of selected SMEs in Sango Otta, Ogun State Nigera. Based on the finding, the study recommended that more financial and social aids/stimuli should be provided for SMEs owners in order to keep them operational during and after the pandemic. The study also recommended that social, health and economic infrastructures such as public health systems, social welfare programs and digital economy should be worked upon.

Keywords: Coronavirus, Coronavirus Disease, COVID-19, Pandemic, Economy, Small and Medium Enterprises

20C/FMS/015P

**EFFECT OF CORONAVIRUS DISEASE (COVID-19) ON EMPLOYEE
PERFORMANCE IN FEDERAL POLYTECHNIC, NASARAWA,
NASARAWA STATE – NIGERIA**

**¹Ahmed Aliyu Tanko, ²Ibrahim Kabiru Bashiru, ³Gambo Mohammed Ibrahim
and ⁴Mohammed Alkai Yero**

^{1,2} Department of Business Administration & Management,

³ Registry Department and ⁴Department of Marketing.

Federal Polytechnic, Nasarawa, Nasarawa State – Nigeria.

babanmusa170@gmail.com;ialhajikabiru@gmail.com;

gambomohammed2015@gmail.com;mohayero@gmail.com

ABSTRACT

The outcome of coronavirus in 2020 had change the educational sector in the world today, most especially academic activities. Employees are expected to perform their duties diligently at the time that their services are needed to meet the challenges posed by COVID-19 but this is often not achieved in practice because their attitudes towards COVID-19 pandemic is too fearful and factors like lockdown, social distancing, wearing of face mask have seriously impacted on performance of employees with an alarming increase of economic consequences. The objective of the study is to investigate the effect of COVID-19 on performance of employee in Federal Polytechnic, Nasarawa (FPN). Data for the work were gathered through questionnaire and analysed using descriptive statistics and chi square was used to test the formulated hypotheses. A population of 855 employees and a sample of 273 were drawn

using Yamane's (1967) simplified formulae. The findings showed that COVID-19 has affected the employee performance in the institution to a very large extent. The study concluded that COVID-19 pandemic affects the performance of employee in the institution. In light of these, the study recommended that training, seminars and workshops should be organized for employees on survival strategy during and after COVID-19 pandemic.

Keywords: academic activities, coronavirus disease 2019, lock-down, performance, social distancing.

20C/LAW/001P

LEGAL ISSUES AND REGULATORY FRAMEWORKS

Okenwa Patience Chinyere

Department of Jurisprudence and International Law, Faculty of Law, University of Lagos,

Akoka

okenwapatience@gmail.com

ABSTRACT

Nigeria is both politically and economically the giant of Africa. It is endowed with rich human and natural resources as a result, it is blessed with abundant business opportunities and its democratic system of government continually attract foreign investors from all over the world. Full understanding of the Nigeria business environment by the foreign investors is very important especially the legal and regulatory frameworks that guides business operation in Nigeria. Distinctive companies need to be well guided before commencing business operation in Nigeria as each have their operation process and requirements. To promote the growth and development of businesses and industries in this technological era, there is need to establish Electronic legal and regulatory frameworks to guide and control the operations and actions of businesses, companies, investors, directors and all other stakeholders. This paper is set to examine the universal enforceability of Electronic Commerce in Nigeria in relation to US and Canada; E-Commerce Legislation and Consumer Protection Laws in Nigeria in this digital technological era.

Keywords: Legal, Issues, Regulatory, Frameworks, Technology, E-Commerce.

**INVESTIGATING THE SUITABILITY OF RESTORATIVE JUSTICE FOR THE
PREVENTION OF ILLEGAL HUNTING IN NIGERIA**

Fochi Amabilis Nwodo

Department of Property Law, Faculty of Law, University of Nigeria, Nsukka
fochi.nwodo@unn.edu.ng

ABSTRACT

Nigeria has criminalised the hunting of several species of wild animals. However, hunters have continued to engage in indiscriminate hunting which shows that these laws have failed to deter illegal hunting in Nigeria. It is worth noting that several researches have linked the Coronavirus Disease 2019 (COVID-19) to the consumption of bats and pangolins in China. Consequently, this crime does not only threaten biodiversity but increases the risk of disease transmission from animals to humans. Stopping illegal hunting is, therefore, important in the quest to save both humans and wild animals. The principal aim of this paper is to investigate how the principles of restorative justice can be incorporated into the criminal justice system in order to prevent illegal hunting. It argues that incorporating the principles of restorative justice into the criminal justice system will help prevent illegal hunting in Nigeria. To justify this conclusion, this study adopts a doctrinal approach. Through the analysis of statutes, case law and relevant literature, this paper finds that merely prescribing fines and punishment without providing an avenue for offenders who are largely illiterates to understand the negative effects of indiscriminate hunting on the environment will not stop the crime. Restorative justice will therefore be effective in preventing illegal hunting because it does not only focus of punishment but gives offenders the opportunity to recognise the harmful effects of their actions on the community.

Key words: Hunting, restorative justice, wild animals, criminal law

**EXPLORING THE POTENTIALS OF ARTIFICIAL INTELLIGENCE
IN JUDICIARY PRACTICE**

Akinode John L. and Oloruntoba Samson. A

Computer Science Department, Federal Polytechnic Ilaro
john.akinode@federalpolyilaro.edu.ng

ABSTRACT

In recent years, there has been massive progress in Artificial Intelligence (AI) with the development of machine learning, deep neural networks, natural language processing, computer vision and robotics. These techniques are now actively being applied in the judiciary with many of the legal service activities currently being delivered by lawyers predicted to be taken over by AI in the coming years. This paper explores the potentials and efficiency of Artificial intelligence (AI) in justice delivery. The paper has two objectives: first to highlight the main applications of AI in justice administrations through some examples of AI tools recently developed; second, to assess the ethical challenges of AI in the judiciary. Artificial Intelligence algorithms are starting to support lawyers, for instance, through artificial intelligence search tools, or to support justice administrations with predictive technologies and business analytics based on the computation of Big Data. Using the concept of Artificial Intelligence (AI), Legal knowledge-based tools may accelerate the service delivery of legal professionals from typical searching of related case journals to extraction of precise information in a customized manner.

Keyword: Artificial Intelligence, Judiciary, Justice administration, Algorithms, ethical challenges

20C/PHM/001P

**COMPARATIVE PUNGENCY DETERMINATION OF TWO CAPSICUM FRUIT SPECIES -
A POTENTIAL NATURAL SOURCE FOR TOPICAL AND TRANSDERMAL
FORMULATIONS IN DIABETIC NEUROPATHIC MANAGEMENT**

¹Ologunagba M.O., ¹Kayode E.O., ²Akinleye, M.O. and ¹Silva B.O.

¹ Department of Pharmaceutics & Pharmaceutical Technology, Faculty of Pharmacy,
University of Lagos, Idi-Araba, Lagos.

²Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Lagos, Idi-
Araba, Lagos

* mologunagba@yahoo.com

ABSTRACT

Nigeria has the highest burden of diabetes in sub-Saharan Africa. Topical and transdermal capsaicin formulations are often used in the management of diabetic peripheral neuropathy (DPN) associated with the disease. The synthetic capsaicin used in the drug formulation is expensive, thereby making the cost of medicament unaffordable for the people living with diabetes in the region hence the need for an alternative natural source. The study therefore sought to quantify the capsaicinoid content of fruits of *Capsicum chinense* and *Capsicum annum* as indicator of pungency. The capsaicinoid concentrations of the acetone fruit extracts of the two capsicum were determined using a High Performance Liquid Chromatography. The values obtained were converted to the Scoville Heat Units (SHU) scale. Capsaicinoid concentration levels obtained from *C. chinense* and *C. annum* were 14.22 and 4.17 mg/g while the corresponding SHU were 255,888 and 75,042 respectively. *C. chinense* is therefore classified as very highly pungent since its pungency level is above 80,000 SHU as compared with *C. annum* and consequently becomes a better therapeutic substitute agent in topical preparations for management of DPN. Keywords: *Capsicum chinense*, *Capsicum annum*, pungency, topical and transdermal formulations, diabetic peripheral neuropathy.

20C/PHM/002P

**DESIGN AND DEVELOPMENT OF AN OPTIMISED CO-POLYMERIC GEL AS AN
ORO - MUCOADHESIVE CARRIER SYSTEM FOR ACTIVE PHARMACEUTICAL
INGREDIENTS**

***Ologunagba M.O., Sipe A.I., Azubuike C.P. and Silva B.O.**

Department of Pharmaceutics and Pharmaceutical Technology, Faculty of Pharmacy,
University of Lagos, Idi-Araba, Lagos.

* mologunagba@yahoo.com

ABSTRACT

Conventional oral therapy is often challenged with therapeutic failure due to dose variability; poor patient compliance and adherence. The mucoadhesive oral drug carrier system is preferred because it addresses these challenges with a positive therapeutic outcome through sustained delivery of the active pharmaceutical ingredients (APIs). Polymers (synthetic and natural) have bioadhesive attributes and can be utilised singly or in combination as polymeric mucoadhesive carriers (PMACs). Hydroxypropylmethylcellulose (HPMC), a synthetic polymer has been commonly combined with other synthetic and natural polymers as PMACs but not with the natural polymers of *Enterolobium cyclocarpum* gum (EcG; Fabaceae) gum and *Grewia mollis* mucilage (GmM; Malvaceae). This study was aimed to design, develop and evaluate an optimised co-polymeric gel consisting of HPMC, EcG and GmM as an oro-mucoadhesive carrier system for active pharmaceutical ingredients (APIs). Pre-formulation characterisations on physicochemical, pharmacognostic, rheological, microbial profiles of EcG and GmM using established methods as well as compatibility assessment of HPMC, EcG and GmM with Fourier Transform Infra-Red (FTIR) spectroscopy were undertaken. Pilot PMAC oral gel formulations were designed and developed. Formulation optimisation was achieved by varying ratio concentrations of EcG, GmM and HPMC. The optimised PMAC gel formulation was characterised and evaluated for its organoleptic, physicochemical, rheological and stability profiles. EcG and GmM had desirable organoleptic properties, pH (EcG: 3.71; GmM: 7.78), viscosity (EcG: 2463; GmM: 17760 mPas), both contained reducing sugars and microbial load profiles were within the Pharmacopoeia limits. The FTIR study indicated polymers compatibilities. The optimised PMAC formulation ratio concentration was EcG 30: GmM 30: HPMC 2. PMAC oral gel formulation had acceptable organoleptic and other desirable properties such as pH (7.5 ± 0.001), viscosity (2460 mPas), spreadability ($72.56 \pm 0.63\%$), easy syringeability, smooth homogeneity, absent syneresis and stability. An optimised novel co-polymeric gel has been successfully developed as an oro-mucoadhesive carrier system for APIs.

Keywords: Co-polymeric gel: Oro-mucoadhesive carrier system: EcG; GmM; HPMC : APIs

A CHEMICAL AND HEAT-FREE METHOD TO EXTRACT *GREWIA MOLLIS* GUM IN ORDER TO IMPROVE ITS PHYSICOCHEMICAL, RHEOLOGICAL AND MICROBIOLOGICAL PROPERTIES

Asenath Echerenwa, Oluwadamilola M. Kolawole*, Modupe O. Ologunagba, Boladale O. Silva

Department of Pharmaceutics and Pharmaceutical Technology, Faculty of Pharmacy,
University of Lagos, Lagos, Nigeria
omkolawole@unilag.edu.ng

ABSTRACT

Grewia gum is a versatile natural polymeric excipient and its preparation from *Grewia mollis* stem bark using chemicals and heat treatment may destroy useful phytochemical components and influence the physicochemical properties of the resultant product. Moreover, there is a need to establish favourable processing and handling conditions to maintain the viscosity of *Grewia* mucilage throughout its shelf life. The aim of this study was to develop a simple and efficient technique to isolate *Grewia* gum from *Grewia mollis* stem bark and evaluate its organoleptic, physicochemical, phytochemical, microbial count and rheological profile. *Grewia* gum was prepared by aqueous maceration of stem bark of *Grewia mollis* for 72 h at room temperature and collection of the gum using sieve (mesh size 2000 μm). The organoleptic (visual examination), physicochemical (flow meter, pH meter, gravimetric method, FT-IR), phytochemical (standard chemical test), rheological (viscometer) and microbiological properties (plate count method) of *Grewia* gum were investigated. The successful isolation of reddish-brown *Grewia* gum was confirmed using FT-IR. The product yield was 67.7 ± 1.9 % w/w. The irregular shaped and rough-textured particles did not compromise its flowability (CI 15.3 ± 1.7 %, HR 1.18 ± 0.02 , AOR 17.6 ± 0.7 °). *Grewia* gum displayed swelling index: 8.3 ± 2.1 %; moisture content: 8.8 ± 0.8 %; total microbial count 65 ± 1 cfu/g and pathogenic organisms (*Pseudomonas aeruginosa*, *Salmonella* spps, and yeast) were absent. Phytochemical constituents include saponins, flavonoids, proteins, amino acids, triterpenoids, phenols, and carbohydrates. The highest mucilage viscosity of 4458 ± 33 mPas was obtained at 25 °C, 10 rpm while 1431 ± 20 mPas was the lowest viscosity recorded at 45 °C, 60 rpm under acidic conditions. A new and cost-effective technique has been

identified to isolate *Grewia* gum. The polymeric excipient could potentially be used to formulate sustained release formulations. *Grewia* gum is a valuable substitute to the synthetic and semi-synthetic polymeric excipient for pharmaceutical applications.

Keywords: *Grewia mollis*, extraction, physicochemical profile, rheology, microbiological profile

20C/PHM/004P

AN EXPLORATION OF UNDER-FIVE CAREGIVERS' BARRIERS TO PROVIDING HOME MANAGEMENT FOR DIARRHOEA WITHIN THE FIRST 24 HOURS IN LAGOS NIGERIA

***Ogbo P.U., Aina B.A. and Soremekun R.O.**

Department of Clinical Pharmacy & Biopharmacy, University of Lagos

* pogbo@unilag.edu.ng

ABSTRACT

Diarrhoea remains the second leading cause of mortality in children with an estimated 205 children under 5 dying daily in Nigeria. Oral rehydration salts and zinc tablets used in combination are appropriate treatment whether at home or in the health facility. Caregivers are major stakeholders in initiating home management within the first 24 hours of recognition. Persistent mortality and poor outcomes in spite of available treatment are indicators of possible barriers to home management among caregivers. The objective was to explore caregivers' barriers to providing home management for diarrhoea within the first 24 hours of recognition. This study was done among caregivers of under-five children attending Primary Health Centres in Ikorodu Local Government Area of Lagos State. It was a qualitative study with the use of semi-structured interview guide. Twelve under-five caregivers who indicated in a previous study that they did not provide any form of home management for the child within the first 24 hours of recognizing diarrhoea were interviewed. Interviews were recorded, naturalized transcription, peer in vivo coding and debriefing were done. Thematic analysis was done and findings were presented as themes and categories. Three main themes emerged: (1) caregivers' concept of diarrhoea, (2) perceived function of ORS and (3) disconnect between potential consequences of diarrhoea and action taken. Categories under the concept of diarrhoea include perceived cause and seriousness of

diarrhoea, and misdiagnosis. Other categories include misinformation from health providers and lack of awareness to potential consequences of untreated diarrhoea. The study showed that caregivers' perception of diarrhoea and the function of ORS and zinc were the main barriers to home management.

Keywords: Diarrhoea, Caregivers, Home Management, Barriers

20C/PHM/005P

POTENTIAL EFFECTS OF POLAR EXTRACT OF *PERSEA AMERICANA* SEEDS ON FEMALE REPRODUCTIVE HORMONAL PROFILE

**^{a*}Ifeoma C. Orabueze, ^aRahmotallah Babalola, ^bObioma Azuonwu, ^cIni-Ibehe Okoko,
George Asare^d**

^aDepartment of Pharmacognosy, Faculty of Pharmacy, University of Lagos, PMB 12003, Surulere, Lagos, Nigeria.

^bDepartment of Medical Laboratory Science, Rivers State University, Port Harcourt, Nigeria.

^cDepartment of Anatomy, Faculty of Basic Medical Sciences, College of Medicine, University of Lagos, PMB 12003, Surulere, Lagos, Nigeria.

^dDepartment of Medical Laboratory Sciences, School of Biomedical and Allied Health Sciences, University of Ghana

*iorabueze@unilag.edu.ng

ABSTRACT

The seed of Avocado (*Persea americana*, Lauraceae) is the non-edible part of the fruit and has been reported as traditional contraceptive and steriliser in Peru and some Asian countries. The focus of the study was to evaluate the possible effect of hydro-methanolic seed extract of *P. americana* on female hormones and reproductive organs and toxicity profile. The effect of daily and orally administered hydro-methanolic extract of *P. americana* seeds on female reproductive hormones of non-pregnant female rats was assayed using hormonal kits. The parameters measured were the serum concentrations of follicle stimulating hormone (FSH) and progesterone (PROG). These parameters were measured on day-30, 60 and 90. Standardization of the extract was done using standard biomarker flavonoids and High Performance Liquid Chromatography (HPLC). The seed extract at three different dose levels (20, 100 and 500 mg kg⁻¹) altered FSH and PROG hormone profile of treated groups. Dose-dependent decrease was obtained for FSH on day-30 (6.95, 3.97, 2.08 IU/L respectively)

compared to untreated group (5.57 IU/L). However, FSH values for the treated groups were observed to have increased dose-dependently for day-60 and day-90. Progesterone increased dose-dependently in the treated groups throughout the 90-day treatment. The progesterone values obtained were significantly higher compared to the untreated group. There was no significant effect on the weight of the reproductive organs as well as their histological features. The result showed that the extract has potent effect on female hormonal profile. Thus, may be used in management of hormone oriented maternal health, hormonal replacement therapy, reproductive health facilities and for contraceptive depending on the dose used. *Persea americana* seed powder should be used with caution in pregnant women and women desiring to conceive. Further studies are recommended to understand the mechanism of action and possible phytochemical constituent(s) responsible for the observed pharmacological activity.

Keywords: *Persea americana*, Seed extract, Female sex hormones, Fertility, Contraceptives

20C/PHM/006P

DIRECT MEDICAL COST OF TREATING SUBSTANCE USE DISORDER IN TWO TERTIARY HOSPITALS IN SOUTH WEST, NIGERIA

^{1*}Margaret O. Ilomuanya, ²Ogochukwu U. Amaeze, ³Chinenye Umeche, ⁴Ugochukwu Mbata, ⁵Omonike Shonekan and ⁵Abayomi Olajide

¹ Department of Pharmaceutics and Pharmaceutical Technology, Faculty of Pharmacy, University of Lagos, PMB 12003, Surulere, Lagos, Nigeria

² Department of Clinical Pharmacy, Faculty of Pharmacy, University of Lagos, PMB 12003, Surulere, Lagos, Nigeria

³ Federal Neuro-Psychiatric hospital (FNPH), Yaba, Lagos, Nigeria

⁴ Department of Mathematics and Statistics, Faculty of Science, University of Lagos, PMB 12003, Surulere, Lagos, Nigeria

⁵ Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Lagos, PMB 12003, Surulere, Lagos, Nigeria

⁵ Federal Neuro-Psychiatric hospital (FNPH), Aro Abeokuta, Ogun, Nigeria
*milomuanya@unilag.edu.ng

ABSTRACT

Effective interventions for opioid use disorders though available are not effectively utilised due to high cost of treatment. Scarce resources faced by substance-use treatment providers and payers of all kinds; evidence of effectiveness is not always sufficient to encourage the

adoption of a given therapy. Economic evaluations can provide evidence that will help stakeholders efficiently allocate their resources. In Nigeria, where there is paucity of resources in the health care sector, there is a need to address if the cost of the impact of opioid abuse is one the health care system can afford. This research evaluates the direct medical cost of treating substance use disorder in two tertiary hospitals in south west, Nigeria. The study is a descriptive, cross-sectional survey of patients with substance use disorders managed at the two Federal Neuro-Psychiatric hospitals, between January and July 2020. This cost of illness study entailed quantifying the direct medical costs involved in the treatment of substance use disorders (SUD). The documented costs are those that the patients incurred during a period of six months starting from their first treatment for SUD. Opioid abuse patients and caregivers had higher rates of comorbidities and greater resource use in both populations compared with controls. Mean excess annual cost per privately insured patient was N120,000. Over the past decade, the annual prevalence of diagnosed opioid abuse more than doubled in both study sites. Opioid abuse has a serious negative impact on patient health and places a substantial economic burden on healthcare system.

Key words: Opioid abuse; Pharmacoeconomics; Health care; Direct medical Costs.

20C/PHM/007P

**SOME NEUROPHARMACOLOGICAL EVALUATION OF THE METHANOL
EXTRACT OF *HYDROLEA GLABRA* SCHUM & THONN.**

Anyanwu-Ndulewe C.A., Adepoju-Bello A.A. and Coker H.A.B.

Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Lagos.
Nigeria.

*cndulewe@gmail.com

ABSTRACT

Neurodegeneration is involved in many debilitating disease conditions and becoming more common with increased longevity. Anxiety, inflammation and a dearth of acetylcholine at neuronal junctions, are part of the complex web of activities leading to dementia, especially of the Alzheimer's type. No singular factor is attributed to this disorder, no cure currently exists and prevailing AD therapy is typically palliative; so, there is a need for sustained research in this regard. It therefore presupposes that a combination of treatments and mechanisms will be involved in the effective management of such disease conditions. This study investigated some neurological profiles of the methanol extract of the leaves of

Hydrolea glabra Schum&Thonn. (Hydrophyllaceae); a plant purportedly used in the management of neurodegenerative disorders. The anxiolytic, and acetylcholinesterase inhibitory capabilities of the extracts, fractions and isolates were studied, using the elevated plus maze, hole board test and phenobarbitone induced sleeping time models in mice and the colorimetric method. Fractionation, chromatographic and various spectroscopic techniques were used to isolate and characterize compounds from the plant extract. Separation and isolation by Ion exchange chromatography on strongly acidic cationic resins Duolite C225 H⁺ and Sephadex LH-20 resulted in two *Cinchona* alkaloids - Cinchonine and Cinchonidine. The methanol extract decreased anxiety-like behaviour in the animal models used and significantly increased the duration of sleep induced by phenobarbitone, at the dose of 200mg/kg b.wt. The butanol fraction gave the strongest enzyme inhibition, with IC₅₀ of 0.10±0.13 mg/ml and Compound 1, 0.21±0.28mg/ml. Cinchonine and Cinchonidine were isolated and reported for the first time in the plant and may account in part for the pharmacological activities recorded. The results of this study therefore give in part, the rationale for its use in traditional medicine, where the plant extract is used in the management of dementia in neurodegenerative conditions.

Keywords: *Hydroleaglabra*, Dementia, Neurodegeneration, Acetylcholinesterase inhibition, Anxiolytics.

20C/PHM/008P

**TUBERCULOSIS – DIABETES MELLITUS CO – MORBIDITY: EVALUATING
TREATMENT OUTCOMES IN A COLLABORATIVE CARE MODEL IN LAGOS
STATE, NIGERIA**

***Ayeni F.A., Oyetunde O.O. and Aina B.A.**

Department of Clinical Pharmacy & Biopharmacy, Faculty of Pharmacy, University of Lagos,
Nigeria.

faayeni@unilag.edu.ng

ABSTRACT

The burdens of tuberculosis (TB) and diabetes mellitus (DM) in Nigeria are high. The presence of DM in TB patients (TBDM) is often unrecognised and management can be challenging, resulting in poorer treatment outcomes compared with outcomes for TB patients only. This study set out to compare treatment outcomes of TB, in TB only and in TBDM patients, when TBDM patients are managed in a collaborative care (CC) setting. The study

was carried out in the chest clinics of two secondary healthcare facilities in Lagos state. A prospective quasi-experimental study, modelled after WHO's Collaborative Framework for Care and Control of Tuberculosis and Diabetes was employed. A total of 671 patients were recruited into the study using a consecutive sampling technique over a period of 12 months. Baseline demographic and clinical data were collected using structured, validated questionnaires. Based on DM screening results, recruited patients without DM were grouped into TB only, and those with DM into TBDM group. TB only patients received the usual TB care under Directly Observed Therapy Short Course (DOTS) program. TBDM patients received DOTS and Collaborative Care. Of 671 participants recruited and screened, 52 (7.7%) were confirmed as TBDM patients. TBDM patients were more commonly females, older than 40 years, and non-obese. TBDM patients reported higher percentages of adverse drug reactions (ADRs) in all organ systems compared to TB only patients. There was no statistically significant difference in the TB treatment outcomes between TBDM and TB only patients when CC was put in place ($p = 0.40$). This study demonstrated the beneficial effect provision of CC with DOTs program had on TB treatment outcomes in TBDM patients.

Keywords: Tuberculosis, Diabetes Mellitus, Collaborative care, Treatment outcomes

20C/PHM/009P

NIGERIAN PROPOLIS: AN INCLUSIVE STUDY TOWARDS ITS USE IN NATURAL HEALTH PRODUCTS AND NEED FOR ITS CONSERVATION

***¹Chinwe Stephenie Alaribe, ¹Akolade R. Oladipupo, ¹Naomi U. Kanu, ¹Ola Adisa O., ¹Okeoma C., ¹Adeyeye A.O., ²Tiziana Esposito, ²Francesca Sansone, ³Adesegun Sunday, ²Imma Pagano, ²Anna Lisa Piccinelli, ²Rita Celano, ⁴Osmany Cuesta Rubio, ¹Herbert Alexander Coker, ⁵Seyed Mohammad Nabavi, ²Patrizia Picerno and ²Luca Rastrelli**

¹Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Lagos, Nigeria.

²Department of Pharmacy, University of Salerno, Fisciano (SA), Italy

³Department of Pharmacognosy, Faculty of Pharmacy, University of Lagos, Nigeria

⁴Universidad Técnica de Machala. Unidad Académica Ciencias Químicas y la Salud, Machala, Ecuador

⁵Applied Biotechnology Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran

ABSTRACT

Propolis is an attractive natural ingredient and one out of many compounds produced by bees. Studies that were carried out in this research include; Comparative analysis of Nigerian

propolis (NP) collected from two geographical (Oyo and Abia) regions; determination of its chemical compositions; α -amylase and α -glucosidase inhibition and antioxidant activities. For the chemical composition, a mixture of ethanol:water (8:3) was used in the extraction and subjected to chromatographic and spectroscopic techniques, antioxidant activity was evaluated by scavenging and chelating effect against 1,1-diphenyl-2-picrylhydrazyl radical and Ferrous ions; TEAC (Trolox Equivalent Antioxidant Capacity) and *in vitro* hypoglycemic effect of NP and its isolated compounds by inhibition of α -amylase and α -glucosidase enzymes. Chemical investigation of Nigerian propolis (NP) led to the isolation and identification of isoflavonoids, diarylpropane, prenylated flavanone. Some were found to be the main markers and new in NP. Comparative studies of samples from Oyo and Abia States showed similarity in phytochemical contents while the quantitative flavonoids content determination showed that in spite of the variability in the concentrations of the flavones, flavonols and flavanones, the two samples had comparable total flavonoid concentrations (TFCs) which were similar and comparable to those of propolis from other parts of the world. NP and its isolates exhibited *in vitro* free radical scavenging activity. For the antidiabetic results, both enzymes were involved in the carbohydrate digestion and their suppression delayed the absorption of glucose with a decreasing of postprandial hyperglycemia. NP inhibited both enzymes with a potency about six times lower than the positive control, acarbose (IC_{50} : 368.0 ± 55.0 and 55.0 ± 2.2 μ g/mL for α -amylase and 51.1 ± 3.5 and 7.5 ± 1.6 μ g/mL for α -glucosidase respectively). All compounds exhibited higher inhibitory effect against α -glucosidase especially; 3,8-dihydroxy-9-methoxypterocarpan and 8-prenylnaringenin which were strong inhibitors of α -glucosidase with IC_{50} values lower than acarbose (IC_{50} : 5.0, 5.2 and 7.5 μ g/mL respectively). These studies suggested NP's usefulness as a good and active ingredient for developing Natural Health Products and hence its sources should be preserved.

Keywords: Nigerian propolis, free-radical scavenging activity, α -amylase and α -Glucosidase enzymes

**HIGH PERFORMANCE LIQUID CHROMATOGRAPHY DETERMINATION OF
FAT SOLUBLE VITAMINS IN SOME VEGETABLES AND FRUITS IN LAGOS,
NIGERIA**

***Orabueze Ogochukwu, Adeyemi David and Johnson Oluwatosin**

Department of Pharmaceutical Chemistry, Faculty of Pharmacy. University of Lagos,
Idi-Araba Campus, P.M.B. 12003, Lagos, Nigeria.

*oorabueze@gmail.com

ABSTRACT

Fat soluble vitamins play a crucial role in maintaining the body healthy and psycho-physiological functioning, from immune system and muscle and heart function, easy flow and clotting of blood as well as eye health. They are critical to the health and wellness of humans. The objective of the research is to use High Performance Liquid Chromatography (HPLC) analysis to quantify the amount of fat soluble vitamins (Vitamin A, D, E and K) in some vegetable and fruit samples purchased from Mushin market in Lagos, Nigeria. The samples include bitter leaf (*Vernonia amygdalina*), Scent leaf (*Ocimum gratissimum*), Bush bock leaf (*Gongronema latifolium*), fluted pumpkin leaf (*Telfairia occidentalis*), Lettuce (*Lactuca sativa*), Wild banana (*Musa acuminata*), Avocado pear (*Persea americana*) and African spinach (*Celosia argentea*) and were authenticated at the Department of Botany, University of Lagos. The plants were extracted from the dried samples with hexane and analyses were performed by HPLC using an analytical reversed phase C-8 (Zorbax Eclipse XDB RP C8 150x4.6mm, 5µm particle size) column and coupled to a UV detector. The concentration of vitamin A was lowest in wild banana (31.768 mg/kg) and highest in fluted pumpkin leaf (678.2024 mg/kg). The content of vitamin D was lowest in wild banana (4.653 mg/kg) and highest in scent leaf (228.407 44 mg/kg). Vitamin E concentration was lowest in wild banana (4.411 mg/kg) and highest in scent leaf (1,657.710 mg/kg) while the concentration of vitamin K was lowest in wild banana (6.691 mg/kg) and highest in fluted pumpkin leaf (14,087.313 mg/kg). Although, green leafy vegetables and fruits are generally known to contain vitamins, this study have demonstrated the trend, specifically for fat soluble vitamins, hence may be considered as a dietary source which may be applicable in the nutrition and food industry as well as other research purposes.

Keywords: Fat soluble vitamins, Fruits, High performance liquid chromatography, Psycho-physiological functioning

20C/PHM/011P

**FORMULATION AND EVALUATION OF MITOMYCIN-C LOADED
CHITOSAN/ β -GLYCEROPHOSPHATE IN SITU GELLING SYSTEMS FOR
POTENTIAL BLADDER CANCER TREATMENT**

^{1*}Kolawole O.M., ²Lau W.M. and ³Khutoryanskiy V.V.

¹ Faculty of Pharmacy, Department of Pharmaceutics and Pharmaceutical Technology,
University of Lagos, Lagos, Nigeria

² School of Pharmacy, The Faculty of Medical Sciences, Newcastle University, Newcastle
Upon Tyne NE1 7RU, United Kingdom

³ Reading School of Pharmacy, University of Reading, Reading, RG6 6AP, United Kingdom
* omkolawole@unilag.edu.ng

ABSTRACT

Conventional chemotherapeutic bladder cancer formulations exhibit poor drug residence within the bladder due to urine voiding. The development of muco-adhesive chitosan based in situ gelling formulations for intravesical application may improve the therapeutic outcomes of bladder cancer patients. The aim of the study was to formulate chitosan/ β -glycerophosphate systems and evaluate the in situ gelling, mucoadhesive and drug release profile, for potential bladder cancer treatment. Chitosan/ β -glycerophosphate (CHIGP) thermo-sensitive formulations were prepared with three different chitosan grades (62, 124 and 370 kDa) using homogenisation method. Their ability to form in situ gelling systems within the bladder (37 °C) was evaluated using vial inversion and rheological methods. Texture analysis was used to study their syringeability through the urethral catheter and intrinsic muco-adhesive properties. The amount of urine required to wash out the 50 % of instilled formulations from porcine urinary bladder mucosa ex vivo (WO₅₀) was evaluated using the urine flow-through technique and fluorescent microscopy. Dialysis method was used to study the *in vitro* mitomycin-C release from CHIGP formulations, and released drug quantified using High Performance Liquid Chromatography. The CHIGP formulations were syringeable and displayed suitable pH of 7.3-7.5. The respective gelation times of LCHIGP, MCHIGP and HCHIGP were 15 $\pm$ 5 min, 7 $\pm$ 2 min, and 5 $\pm$ 1 min. The gelation temperatures of LCHIGP, MCHIGP and HCHIGP were 30.4 $\pm$ 0.3°C, 29.8 $\pm$ 0.2°C and 29.6 $\pm$ 0.1°C, respectively. The WO₅₀ (9.3 $\pm$ 0.9 mL), Work of adhesion (0.35 $\pm$ 0.02 N mm) and

sustained drug release profile (37 ± 17 % released over 6 h) of HCHIGP was superior relative to other formulations. The molecular weight of chitosan dictated the thermogelling, syringeability, mucoadhesive and drug release behaviour of the CHIGP systems. HCHIGP systems could potentially be used for the formulation of chemotherapeutic agents for bladder cancer treatment.

Key words: Chitosan/ β -glycerophosphate, Mitomycin-C, In situ gelling, Bladder cancer

20C/PHM/012P

**MEDICATION ADHERENCE AMONG TYPE 2 DIABETES PATIENTS
ATTENDING A TERTIARY HOSPITAL: A QUALITATIVE EXPLORATION
OF BARRIERS AND FACILITATORS**

***Onwuchuluba E.E., Soremekun R.O. and Oyetunde O.O.**

Department of Clinical Pharmacy & Biopharmacy, Faculty of Pharmacy

University of Lagos, Akoka, Lagos

eonwuchuluba@unilag.edu.ng;ebyee_iyke@yahoo.com

ABSTRACT

Medication adherence is pivotal for patients' health outcomes. Few studies have explored the barriers and facilitators of adherence to antidiabetic medications (ADMs) from patients' perspectives using socio-ecological models (SEM). Qualitative methods were used to collect information from twenty-five purposively selected T2DM patients attending a Tertiary Hospital in Lagos, Nigeria. The semi-structured interviews comprised of questions on patients' experience of diabetes, ADMs, and health system. The interview sessions were tape-recorded and transcribed verbatim. Thematic analysis-the framework approach was used to analyse data. NVIVO 10 assisted in data analysis and storage. About 60% of the participants were females, 56% were on at least two ADMs and none of them were on health insurance. This study found that multilevel barriers hindered patients' adherence. Individual level (negative perceptions of T2DM), Organisational (multiple prescribers), and Interpersonal (lack of spousal support) factors were the most prominent barriers. Gender differences in what constitutes spousal support and stigma were reported. High cost of the ADMs encouraged seasonal and complementary use of herbals. The patients' perceived need to live longer, save, and purchase ADMs in bulk facilitated adherence. Tackling non-adherence problem requires multilevel intervention incorporating motivational counselling, spousal

support and the training of Health Care Professionals (HCPs) for a change in practice.

Keywords: T2DM, Adherence, Barriers and Facilitators, Qualitative Methods, SEM

20C/PHM/013P

DISTRIBUTION OF SUPERANTIGEN TOXIN GENES IN CLINICAL AND COMMUNITY ISOLATES OF STAPHYLOCOCCUS AUREUS

^{1*}Enwuru N.V., ²Adesida S.A., ³Enwuru C.A., ⁴Ghebremedhin B. and ⁵Coker O. Akitoye

¹Department of Pharmaceutical Microbiology & Biotechnology, Faculty of Pharmacy, University of Lagos, Nigeria.

²Department of Microbiology, Faculty of Science, University of Lagos, Nigeria.

³Department of Public Health, Nigerian Institute of Medical Research, Lagos, Nigeria.

⁴Institute of Medical Microbiology, Otto-von-Guericke University, Germany.

⁵Department of Medical Microbiology and Parasitology, Babcock University Teaching Hospital, Ilishan-Remo, Ogun State, Nigeria.
nenwuru@unilag.edu.ng; nenwuru@gmail.com

ABSTRACT

Staphylococcus aureus pathogenicity is mainly due to the production of a number of secreted and cell surface-associated proteins under the control of the quorum-sensing accessory gene regulator (*agr*) system. This study investigated the presence of superantigen toxin (SAg), *tst*, the *agr* regulatory system and methicillin resistance genes in *S. aureus* from clinical and community settings. Seventy clinical and 22 nasal isolates of *S. aureus* were identified using conventional methods and Vitek 2 system (BioMerieux, France). The isolates were screened for accessory gene regulator (*agr*), superantigen (SAg) as well as methicillin resistance genes using multiplex PCR. Twelve (12/70; 17.1%) MRSA strains were identified among the clinical *S. aureus* isolates and none among the community strains. Eighty-nine isolates were grouped into *agr* types 1-4, and 3 were untypeable. The MRSA strains belonged to *agr*¹ and *agr*³ and contained only 3 types of *se* genes: *sea* (10), *she* (6) and *sei* (2). CL-MSSA isolates were classified into *agr*¹ (23), *agr*² (13), *agr*³ (16) and *agr*⁴ (7) and 5 enterotoxin gene types: *sea* (16), *seb* (10), *sec* (5), *seg* (16) and *sei* (40). *sec* was present only in CL-MSSA. The NS-MSSA belonged to groups *agr*¹ (9), *agr*² (8), *agr*³ (8) and *agr*⁴ (1) and were largely positive for *sea* and *sei* genes. Only four (4/92; 4.3%) *tst* 1 gene were identified. Our work showed that *agr*¹ and *agr*³ *S. aureus* strains dominated the settings investigated and *sea*, *sei*, *seb*, *seg* and *seh*, *sec* and/or *tst* genes were linked to their pathogenicity.

Keywords: *agr* group, methicillin resistance, SAg toxin genes, *Staphylococcus aureus*

THE IMPACT OF GOVERNMENT EXPENDITURE ON ECONOMIC GROWTH IN NIGERIA

¹*Ekpenyong Orok Bassey, ²Muhamud Abdallah and ³Orlu Lucky

¹Institute of Economists of Nigeria, P. O. Box 27988, Ibadan, Oyo State, Nigeria.

²Department of Public Administration, University of Calabar.

³River State University, Faculty of Social Science, Department of Economics.

*orokekpenyong@yahoo.com

ABSTRACT

This research work studies the impact of government expenditure on economic growth in Nigeria for the period of 1981- 2018, which was used to determine the long-run effect of government expenditure on the economic growth in Nigeria. The main objective of the research focuses on assessing the impact of government expenditure on economic growth in Nigeria for the stipulated period, as alighted in the variables used in the study, this includes evaluation of how recurrent expenditure on education, health, agriculture, road and infrastructure, transportation, communication and defense aided the gross domestic product in Nigeria. The data were obtained from CBN statistical bulletin. The independent variable is gross domestic product, while dependent are recurrent expenditure on education, health, agriculture, road and construction, transport and communication and on defense. Econometric and statistical methods of data analysis were adopted as a major analytical tool. In conclusion, the study shows that government expenditure has contributed to the GDP in Nigeria within stipulated period. The findings explained that government expenditure impacts on the economic growth, but not in a way that brings about an improvement in the micro-economic objectives, by implication the pattern of expenditure is tilted more on recurrent expenditure than capital expenditure. It is therefore recommended that there must be a framework in the areas mentioned, as same will give ways for economic sustainability as well as enhancing the living standard of the people and also suggest that investment in microeconomic sectors of the will have a multiplier effect on the society.

Keywords: Agriculture sector, Nigeria economy, macro-economy

**TOWARDS A (SEPARATE) LEGISLATION FOR ASSESSING THE SOCIAL
IMPACT OF PROPOSED BUILDING PROJECTS IN NIGERIA**

Ndukaeze Nwabueze

Department of Sociology, University of Lagos

ABSTRACT

The enactment of the Environmental Impact Assessment (EIA) Act, 1992 without a complementary Social Impact Assessment Act (SIA) creates a problematic gap in protecting the environment and ensuring its sustainability. The policy creates a gap in that while EIA aims to save the environment, it ignores the impact of developments on the human condition. Meanwhile, it is humans that carry out development activities, which have interests, needs and constraints that determine how they exploit, abuse or promote the physical environment. The question is why SIA after 32 years of the Harmful Waste Act of 1988? The answer is that although the Koko toxic waste dump of 1988 sparked off environmental awareness, it supported EIA but not SIA. EIA Act 1992 and NESREA Act 2007 aimed to protect the physical environment and made only casual reference to human issues. This study advocates the enactment of SIA legislation to complement EIA Act and properly save the Earth. The University of Lagos developed a curriculum on SIA for the MEM programme titled - Concepts, Issues and Techniques of Social Impact Analysis. With ten-year hindsight teaching this curriculum evidence abounds that EIA without SIA is unsustainable. The SIA curriculum developed Concepts, Principles, Issues, Theories and Techniques of SIA reporting. Borrowing ideas from EIA Act the rest of SIA legislation will be teased out.

Keywords: Separate SIA legislation. Policy gap. Social sustainability. Social Impact Analysis. Saving the Earth

**CLIMATE CHANGE AND THE POLITICS OF DISASTER MANAGEMENT IN
NIGERIA: THE CYCLONE IDAI WARNING**

Bamidele Olajide

Department of Political Science, University of Lagos, Akoka, Nigeria
Department of Politics and International Relations, North West University, Mafikeng
Campus, South Africa
contactdele@gmail.com

ABSTRACT

Nigeria like other African countries is prone to climate change and its effects. Climate change causes ecological events that result in massive loss and damage to the people. One of such events was the Cyclone Idai which ravaged the countries of Malawi, Mozambique and Zimbabwe in 2019. The event was the first time climate change caused near-total destruction of a city, that is, Beira in Mozambique. Cyclone Idai wiped roads, bridges and dams. It also destroyed over 100,000 homes, displaced over 17,000 households, totaling about 87,000 individuals. The United Nations estimated the cost of damage \$773 million in buildings, infrastructure and corps. This is qualitative research relying on data from secondary sources. This paper opines that Cyclone Idai portends a warning for African countries on disaster management including Nigeria as the event showed that the affected countries' disaster management is weak. It argues that disaster is a social construction and as a result, there is a lack of tailor-made disaster preparedness education for vulnerable citizens. The paper also maintains that intergovernmental coordination of disaster management in Nigeria is weak. The failure of the Nigerian state in disaster management comes to the fore regularly with rising incidences of erosions and flooding and other environmental challenges, all traceable to climate change. The paper concludes that the disaster management profile of Nigeria needs to be improved to heed the warning from the Cyclone Idai to avoid the huge humanitarian crisis of its aftermath.

Keywords: Climate change, Environment, Disaster Management, Nigeria, Cyclone Idai

**TOWARD ENHANCING THE ROLES OF CIVIL SOCIETY ORGANIZATIONS IN
VOTER EDUCATION IN NIGERIA**

Modu Lawan Gana

Department of Public Administration, Mai Idris Alooma Polytechnic, Geidam, Yobe State
gana.lawan@yahoo.com

ABSTRACT

This concept paper analysed the challenges of inadequate voter education on the Nigeria electoral system. The analytical data was obtained from secondary materials of published and unpublished sources. Voter education is one of the cardinal principles of democratic politics and ensuring credible elections in any democratic society. The imperative of this cannot be underestimated in developing democracy like the Nigeria state. Since 1999, electoral processes in Nigeria were alleged to be full of irregularities ranging from violent electioneering campaigns, unwarranted voting behaviours of election rigging such as multiple voting, ballot snatching, vote selling among others. These unruly behaviours are seriously undermining the integrity of the Nigeria's electoral system. Although, numerous political-legal measures were taken by the Independent National Electoral Commission including the introduction of the digitalised card reader machine, as well mobilisation of thousands of the country's security apparatus to ensure hitch-free elections, yet the unruly behaviour of the voters continues to flourish on the electoral processes. The article concludes that the persistence of electoral fraud in Nigeria is influence by inadequate voter education in the country. It thus recommended that, as a panacea to combat the perennial crisis of the electoral fraud as well as to enhance future elections, the Nigeria government should engage civil society and community base organisations to educate voters toward ensuring and sustaining hitch free, fair and credible elections in the country.

Key words: Civil Society; Voter Education; Electoral Process; INEC

COVID-19 AND NATIONAL SECURITY IN NIGERIA

***Emmanuel Olawale Fapetu, Omololu Soyombo and Franca Atttoh**

Department of Sociology, Faculty of Social Sciences, University of Lagos.

*emmanuelolawale5@gmail.com

ABSTRACT

The emergence of COVID-19 in Wuhan, China was not initially seen as a global problem until it spread to different countries of the world and Nigeria inclusive posing a serious threat to lives of the citizens. The advanced countries used physical distancing and lockdown as mechanisms for preventing the spread of the disease with welfare provisions made. The Nigeria government at both federal and state levels decided to use the same mechanisms but have been confronted with serious security issues. This paper aims at examining security issues that emerged amidst the COVID-19 lockdown period in the country. The paper is a desk review of literature involving resource materials from the internet, newspapers, press releases and official statistics relating to the subject matter. The Broken Window theory serves as the basis of analysis with the basic assumption that when a country is having unresolved problems and irresponsible government, the country is bound to face the insurgence of criminal activities in the face of any imported threat to national safety. This paper argues that high poverty rate, proliferation of criminal groups, high unemployment rate, and lack of social welfare provision for citizens together with other factors in the country contributed to the high rate of insecurity during COVID-19 lockdown period. This paper concludes that if any country fails to solve its internal problems criminals will take advantage of the situation to carry out their criminal actions whenever the country is faced with the incursion of external threat.

Keywords: Crime, COVID-19, Lockdown, National Security, Physical Distancing

**COVID – 19 PANDEMIC AND HEALTH CARE SYSTEM AS PREDICTORS OF
PSYCHOLOGICAL WELL BEING IN NIGERIA**

Olajide Olufunmilayo A¹, Arowosegbe Christiana K², Omoniyi Morenike E³

¹Department of General Studies, Federal Polytechnic Ede, Osun State.

²Department of Psychology and Behavioural Studies. Ekiti State University, Ado- Ekiti.

³Department of Psychology, University of Nsukka.

olajideolufunmilayo75@gmail.com; ajilakehinde@yahoo.com;

morenike.omoniyi@unn.edu.ng

ABSTRACT

The study examined the impact of Corona virus and the health care system as these affect Psychological well-being in Nigeria using the reports from Nigeria Centre for Disease Control (NCDC) and World Health Organisation (WHO). A state of emergency was declared globally due to the pandemic which caused acute respiratory syndrome that ravaged the world in 2020. The first report about Corona virus disease 2019 (COVID-19), was from Wuhan, Hubei Province, China in late December, 2019. The World Health Organisation declared the disease an international public health emergency and a pandemic on 11th March, 2020 (WHO; 2020). The progressive rising number of cases of the pandemic in the world is alarming (Olajide, 2020). There are over 180 million people infected globally and about 692 thousand deaths were recorded (Corona virus Resource Centre, 2020), which included 888 deaths in Nigeria (NCDC, 2020). The dawdling rate of growth of health care system service delivery in Nigeria cannot be over emphasised and the effect on Psychological well-being of the Nigerian populace is eminent. Authors conclude that there is strong link between COVID-19 and health care system. These have significance on the psychological well-being of Nigerians. It can be suggested that the peak of the pandemic has not been reached with progressive rising number of cases globally.

Keywords: Corona virus, COVID-19, Nigeria, Health Care System, Psychological well-being.

**FACT OR FICTION ABOUT COVID-19 DEATH TOLLS:
PSYCHOLOGICAL IMPLICATIONS**

Nwoke Mary Basil, Kalu T.U. Ogba and Nwifo Juliet Ifeoma

Department of Psychology, University of Nigeria, Nsukka

marybasil.nwoke@unn.edu.ng; kalu.ogba@unn.edu.ng; nwifo.ifeoma@unn.edu.ng

ABSTRACT

Global and local news about Corona virus (COVID-19) has, on daily basis for over eight months, been prevalent in the media and various social networks; disseminating various information about the virus. Such information includes but not limited to: origin and cause, contending measures and compliance to the measures, possible vaccine/cure/solution, politics, belief, myths and coping with the virus, as well as infectious, recovery and death tolls. More worrisome is the daily global reports of frightening death tolls. In x-raying the psychological implications of this death tolls, this study examined the fact or fiction about COVID-19 death tolls. Results of review of literatures showed that most people do not doubt the existence of COVID-19-(fact), but are absurd about the reported death tolls-(farce). Also, the non-concrete information given to the affected individuals as well as keeping them in the dark affect their mental health. Hence, there is a certain level of fear, anxiety and panic, boredom, withdrawal, cognitive decline etc in the people. Theory of Social Strain explains the psychological implications. It was recommended that accurate information regarding COVID-19 death tolls be reported and that proper psychological well-being of the populace in this vulnerable time be absolutely essential; becoming the top priority of the authority/government.

Key words: Covid-19, death tolls, fact and farce about death tolls, psychological implications.

**AN APPRAISAL OF THE ECONOMIC RECOVERY AND GROWTH PLAN AND
STAKEHOLDERS' PERSPECTIVES ON THE ENHANCEMENT OF ECONOMIC
GROWTH AND DIVERSIFICATION IN NIGERIA**

^{1,*}Ndubisi I. Nwokoma, ¹Babatunde W. Adeoye, ²Babatunde Oke, ¹David M. Oke,
¹Taiwo V. Ojapinwa, ¹Anthonia T. Odeleye, ¹Onyebuchi Iwegbu and ¹Aminat Eniayewu

¹Department of Economics, University of Lagos, Akoka, Yaba, Lagos

²Department of Finance, University of Lagos, Akoka, Yaba, Lagos

*ndugoodman@yahoo.com;nnwokoma@unilag.edu.ng

ABSTRACT

Nigeria's economic growth has been principally driven by growth in the oil sector. Before the advent of crude oil in 1960-1970, the non-oil sector led by agriculture and manufacturing, among others contributed an average of 80% to output, which declined to 52.1% between 1981 unlike the services sector which grew by about 63.4% between 2001 and 2017. Over time, the non-oil sector has not substantially contributed to the country's economic growth. Since over-reliance on the oil sector has proven not to be sustainable, the Nigerian government developed a (2017-2020) medium-term policy strategy - the Economic Recovery and Growth Plan (ERGP) to enhance growth and unleash the potentials of the non-oil sector to guarantee macroeconomic stability and economic diversification. This study, thus conducted an assessment of the performance of the ERGP in its first two years of implementation as well as the perspectives of relevant stakeholders including market women, traditional institutions, youths and public servants, among others, in terms of its strategy towards achieving economic diversification and economic recovery. A two-pronged approach was used in the study. First, the performance of the ERGP is benchmarked against actual official data over the relevant period to assess the reliability of the set targets. Second, stakeholder perspectives were obtained through a survey using Lagos State, a melting pot of all ethnicities in Nigeria, where over 50 percent of commercial activities in Nigeria take place. The main finding shows that the ERGP forecasts for real GDP growth rate fell short of the actual National Bureau of Statistics values for the entire plan period under review, from the first quarter of 2017 to the third quarter of 2019, with the gap widening beyond the fourth quarter of 2017. Further results indicate that by the second quarter of 2019, the ERGP target of 4.5%, for example was higher than the official actual value of 2.28%. Stakeholders survey

indicate that only 29.1% of the respondents expressed pleasure on the exchange rate. Therefore, strengthening of institutions and the policy formulation process will enhance effective policy implementation and the fast tracking of economic growth and diversification processes in Nigeria.

Keywords: Economic Policy; ERGP; Economic Growth; Economic Diversification

Journal of Economic Literature (JEL) Classification: E61; O21; O40; O11

20C/SSC/010P

AN EVALUATION OF THE GOVERNMENT PROGRAMME OF INVESTING IN THE PEOPLE: A STAKEHOLDER'S PERSPECTIVE

^{1,*}Ndubisi I. Nwokoma, ¹Babatunde W. Adeoye, ²Babatunde Oke, ¹David M. Oke, ¹Taiwo V. Ojapinwa, ¹Anthonia T. Odeleye, ¹Onyebuchi Iwegbu and ¹Aminat Eniayewu

¹Department of Economics, University of Lagos, Akoka, Yaba, Lagos

²Department of Finance, University of Lagos, Akoka, Yaba, Lagos

*ndugoodman@yahoo.com, nnwokoma@unilag.edu.ng

ABSTRACT

Human capital development and social inclusion have become central concerns for policymakers worldwide. These concerns arise from poor articulation and implementation of programmes targeted at enhancing the investment in the people in many societies. Hence human capital development and social inclusion have suffered setbacks in many countries. Over the years, Nigeria has not ranked well on human capital index and thus its poverty level has continued to rise. A major disconnect in analysing policy programmes in Nigeria is that the achievement of outcomes in this regard, are scarcely reviewed from stakeholders' perspectives. This study thus stands to fill this gap by examining the targets of the Federal Government Economic Recovery and Growth Plan (ERGP) covering the 2017-2020 period and its performance in the first two years of implementation. Using a survey approach, the opinions of stakeholders across the five administrative divisions in Lagos State, namely Ikorodu, Badagry, Ikeja, Lagos and Epe were adopted and analysed. This provided a representative case for Nigeria in terms of ethnicity, social class, rural, semi-urban and urban population. Given that over 50 percent of commercial activities in Nigeria take place in Lagos with virtually every ethnic group in Nigeria represented in the state. The findings from the survey results show that gaps in job creation increased from 1.5% in 2017 to 5.10 in 2020

with unemployment worsening and government unable to meet its targets on job creation and empowerment of its youthful population. In addition only 38.5% of respondents said that the social inclusion strategy through the “Trader money” scheme etc was well administered. The implementation of the ERGP thus failed to improve on the human capital contributions to the wide economy growth process. Also, the plan has not successfully been able to integrate the populace into the growth process of the nation. Therefore, functional education policy, robust and modern health facilities and programmes as well as running an inclusive government should be made the priority of government priorities.

Keywords: Economic Policy; ERGP; Human Capital Development; Economic Welfare

Journal of Economic Literature (JEL) Classification: E61; O21; I25; I38

20C/SSC/011P

**A STAKEHOLDERS’ ASSESSMENT OF THE ENHANCEMENT OF THE
COMPETITIVENESS OF THE NIGERIAN ECONOMY THROUGH THE
ECONOMIC RECOVERY AND GROWTH PLAN**

^{1,*}Ndubisi I. Nwokoma, ¹Babatunde W. Adeoye, ²Babatunde Oke, ¹David M. Oke,
¹Taiwo V. Ojapinwa, ¹Anthonia T. Odeleye, ¹Onyebuchi Iwegbu and ¹Aminat Eniayewu
¹Department of Economics, University of Lagos, Akoka, Yaba, Lagos
²Department of Finance, University of Lagos, Akoka, Yaba, Lagos
*ndugoodman@yahoo.com, nnwokoma@unilag.edu.ng

ABSTRACT

The Keynesian postulate on the importance of the role of the state in economic development has propelled many governments across the world to enhance job creation and the reduction of income inequality. Addressing these issues have been proven to be better achieved within the context of globalization and the focus of enhancing the competitiveness of the domestic economy. In this regard, this study examines the performance of the Federal Government of Nigeria’s medium-term Economic Recovery and Growth Plan(ERGP) between 2017-2020 period, in relation to the objective of building a globally competitive economy. The analysis was based on stakeholders' perspectives on the subject using the case of Lagos State, a microcosm of Nigeria. Survey method was employed and respondents were randomly selected from the five administrative divisions or IBILE in Lagos, namely, Ikorodu, Badagry, Ikeja, Lagos and Epe. The results from descriptive and inferential analysis show that the ERGP’s focus on good governance through the fight against corruption did not produce the

desired results with the Transparency International (TI) Corruption Perception Index for Nigeria worsening from 136 in 2016 to 148 in 2017 in comparison to the Comoros Islands and Guinea in this regard. Survey results indicate that only 42% of the respondents perceive the business atmosphere becoming friendlier and only 39.7% expressing the capacity of their businesses effectively competing with counterparts in other parts of Africa. Overall, the ERGP appeared weak in building a globally competitive economy, as envisaged. Therefore, it is recommended that government should focus on developing a conducive macroeconomic environment and institutional framework that would enhance the competitiveness and operational efficiency of the economy.

Keywords: Economic Policy; ERGP; International Linkages to Development; Economic Impact of Globalisation

Journal of Economic Literature (JEL) Classification: E61; O21; O19; F60

20C/SSC/012P

REPOSITIONING THE PRACTICE OF FATTENING ROOM AS PARTICULAR CULTURAL RESOURCE FOR SUSTAINABILITY

Ifeyinwa V. Awagu

Pan-Atlantic University, Lagos

iawagu@pau.edu.ng

ABSTRACT

Sustainability drives the safeguarding of cultural practices and operations that generate income. It also identifies, raises awareness and catalyses actions towards particular cultural resources that are germane to the development of a sustainable society. Current trends in development focus on innovative strategies designed to meet challenges of particular societies. As generations are born into local communities, the formal and informal socializing institutions and education integrate them into the natural and social resources ingrained in the people and their environment. The cultural practice of fattening room is a rite of passage that launches young maidens into mental, psychological and physical readiness to start families. The centuries-old rite of passage from adolescence to womanhood focus on orienting the maidens on the rubrics of wife and motherhood in all the traditional ramifications. Given the emerging significance of culture based economic activities in development, the practice of

fattening room could constitute raw materials which mobility in the economy would depend on its preservation and commercialization. Using conceptual and critical analysis, this paper examines the fundamentals of the practice of fattening room as an intangible cultural resource in South Eastern Nigeria. Beyond preparing them for family life, the fattening room can function as a period of exposing and educating the young maidens in skill acquisition based on the available natural resources provided by the topography of the area. Thus, they graduate with social and financial skills. It argues that the cultivation of critical thinking and entrepreneurship skills in the youth would turn the intangible cultural heritages into both financial profits and talent explosions that are engines for sustainability. It specifically recommends a review of the curriculum of formal and informal youth education and socialization to engender the preservation and conversion of the intangible cultural heritages to economic opportunities, products and services in Nigeria.

Key words: sustainability, intangible culture, financial and social skills

20C/SSC/013P

HOUSEHOLD WELFARE AND HEALTH CARE SPENDING IN A COVID-19 ECONOMY: IMPLICATIONS FOR POLICY DEVELOPMENT

¹Osobase, Anthony Onogie and ²Ohioze, Wilson Friday

¹Department of Economics, University of Lagos, Lagos

²Department of Economics, National Open University of Nigeria, Abuja
osobaseanthony22@gmail.com

ABSTRACT

The study examines the nexus between household welfare and health care expenditure during-and-after the COVID-19 lockdown in Lagos state, Nigeria. Specifically, it explores the effect of out-of-pocket-health expenditure on per capita food consumption of households in Lagos metropolis. The theoretical underpinning is based on the Grossman-Wagstaff health production theory. The study adopts random sampling technique to select 10 Local Government Areas (LGAs) from the 20 LGAs in the State and the sample size is made up of 150 heads of households purposively drawn from each LGA. Both descriptive statistics and ordinary least square techniques are utilized to analyze the data. From the findings, it was observed that out-of-pocket-health spendings has a negative effect on per capita food consumption of households. Based on the findings, policies that will enhance the welfare and means of livelihood of households were recommended.

Keywords: Household welfare, health care spending, ordinary least square technique

20C/SSC/014P

VERSTEHEN AS A SOCIAL SCIENCE TOOL.

Amadi Chibuike E. and Olajide Olufunmilayo A.

General Studies Department, Federal Polytechnic, Ede, Osun State, Nigeria.

chibuike4jesus@gmail.com; olajideolufunmilayo75@gmail.com

ABSTRACT

A definition, or description of the nature of humans has always been a turbulent adventure in philosophy. Thomas Hobbes and John Locke's definitions of human nature for instance, both failed to provide certainty regarding how human beings will act in a particular way, and they are consequently to be considered as descriptive attempts that only states why humans ought to be in political and civilized states rather than prescribe or describe how humans act. However, with the development of science, and its popular image comes the assumption that human experience, actions, and phenomena can be studied using the apparatus that have been successful in science. A consequence of this is that human actions, behaviours and nature can be described empirically. There is a problem of ascertaining the understanding of human nature since human actions are not always predictable. As a consequence, therefore, there is insistence on the idea of understanding. This means that while studying human beings and human phenomena, understanding plays a major role, and in some cases, it is all that we ought to rely on for adequate interpretation of human actions both individually, and within groups. This is where the term, verstehen, takes preeminence. Through the method of critical inquiry and evaluation, a critical exposition of the term and why it has come to be a central notion in the social sciences' description of human phenomena was examined.

Key words: Verstehen, Social Sciences, Phenomena, Behaviours

20C/SSC/015P

**“TRADITIONAL INSTITUTION AND CONFLICT RESOLUTION IN NIGERIA”:
SOCIAL WORK ANALYSIS**

¹Bukie Fidelis Bukie, ²Perpetua Lum Tanyi and ³Andre Pelser

¹Department of Social Work, University of Calabar

²Department of Social work, University of Nigeria Nsukka

³Department of Sociology, University of the Free State, Bloemfontein, South Africa

bukiefbukie@unical.edu.ng; lum.tanyi@unn.edu.ngl; PerpetuaT@ufs.ac.az

ABSTRACT

Traditional institutions in African societies and elsewhere are known to hold sacred peacemaking processes, formed from centuries of traditions and customs before the disruption by colonial administration, that introduced adjudication and arbitration, that are converse to traditional method of conflict resolution. These contemporary patterns of conflict resolution are rather flawed in dealing with the challenges posed by modern conflict in Nigeria. This study therefore examines the role of traditional institutions in conflict resolution in Nigeria from a social work perspective. Data was generated from secondary sources only. The study was anchored on System theory of Ludwig Bertalanffy in 1956. The study revealed that the traditional conflict resolution method as practiced in Nigeria is better than the modern adjudicative method of conflict resolution, because it is faster and non-adversarial. The study recommends among other things a reversal to traditional methods of conflict management and resolution because it is friendlier, faster, cheaper and devoid of post conflict resolution animosity.

Key words: Conflict, traditional institutions, culture, social work and resolution.

20C/SSC/016P

**EMERGING PANDEMIC AND HOUSEHOLDS' WELFARE: A CASE OF
COVID-19 MORBIDITY**

¹Dauda R.O.S., ^{2*}Ohioze W.F. and ¹Osobase A.O.

¹Department of Economics, University of Lagos

²Department of economics, National Open University of Nigeria

*ohiozewf@gmail.com

ABSTRACT

A pandemic that has greatly obstructed the growth of world economy in the 21st century is coronavirus, now officially known as COVID-19. The novel pandemic is an infectious

morbidity caused by severe acute respiratory syndrome. However, since the morbidity became an epidemic, measures such as physical distancing, hand washing, wearing of nose mask and eventual lockdown have been taken to slow down its spread. It is therefore apparent that, these measures especially the total lockdown occasioned by the emerging pandemic may have somehow adversely affected households' welfare. Based on this, the study investigates the impact of Covid-19 pandemic on households' welfare in Lagos State. Two theories, the Engel law of food expenditure of households and the unitary household production underpin the study. They (The theories) see households as economic units where members' welfare is impacted as variation occurs in their means of livelihood. Thus, the study adopts simple random sampling to select 12 out of the existing 20 Local Government Areas in the State. Convenient sampling is utilized to select 100 heads of households from each Local Government Areas, amounting to 1, 200 sample size. Both descriptive statistics and binary logistic regression techniques are used to evaluate the data collected. The finding reveals that households' welfare is negatively and badly impacted by Covid-19. Thus, there is need for meaningful policy response from constituted authorities to cushioning this impact, and put in place enduring intervention strategies to neutralize any future occurrence.

Keywords: COVID-19, Household Welfare, Pandemic, Morbidity

20C/SSC/017P

**LEARNED HELPLESSNESS, FEAR OF NEGATIVE EVALUATION AND
IMPAIRED FAMILY RELATIONSHIP AS PREDICTORS OF SUICIDAL
IDEATION AMONG UNDERGRADUATES OF UNIVERSITY OF LAGOS**

***Aroyewun Bushura Afolabi, Oyogho Oscar Victor and Kazeem Halimah Taiwo**

Department of Psychology, University of Lagos

*aaroyewun@unilag.edu.ng

ABSTRACT

Suicide in developing countries in Africa, especially among the young people emerging from their teens and late adolescents, is sadly becoming a norm. Formerly seen as a taboo subject of enquiry and research, more and more attention is being paid to it as the numbers rise albeit slowly in the Nigerian society. This study investigates the relationship between learned helplessness, fear of negative evaluation, impaired family relationship, and suicide. A total of 332 participants (114 males and 218 females), undergraduate students of the university of

Lagos, selected via randomised sampling method, were a part of the study for data collection purposes. Questionnaires were used to collect data. A total of 3 hypotheses were tested and analysed using Product Moment Correlation Regression analysis, and the T-test for independent means. Results showed a correlation between all variables considered, with learned helplessness and fear of negative evaluation and impaired family relationship, predicting suicidal ideation, while there were no significant differences in suicidal ideation due to age. Results showed that suicidal ideations could be linked to family issues, as well as a negative view of the self.

Keywords: Suicidal Ideation, learned helplessness, fear of negative evaluation, age, university undergraduates.

20C/SSC/018P

**IMPACT OF COVID-19 LOCKDOWN ON INFANTS/TODDLERS-PEER
INTERACTION AND SOCIAL INTELLIGENCE: A PSYCHO-SOCIAL
PERSPECTIVE**

**¹Morenike E. Omoniyi, ²Olatunde P. Olaleru, ³Olajide,
Olufunmilayo A and ¹Alex C. Ozoani**

¹Department of Psychology, University of Nigeria Nsukka, Enugu State.

²Department of English & Literary Studies, University of Jos, Plateau State.

³Federal Polytechnic Ede, Osun State.

morenike.omoniyi@unn.edu.ng

ABSTRACT

This study aimed at exploring the impact of COVID-19 lockdown on infants and toddlers' interaction with their peers and their social intelligence. The level of mistrust and shame that would be exhibited by these sets of children has been so high even after the lockdown due to the physical and social distancing created by this pandemic. An experimental approach is adopted in different social settings such as schools, play grounds and worship centers, whereby the peer interaction amongst infants and toddlers were observed and their social intelligence measured. This study suggested that inasmuch as safety precautions need to be taken by parents, these children should be helped to still maintain contact with their peers in their neighbourhood and parents should also maximise the social media- initiating regular phone calls (video/voice call) and expose them to viewing children-friendly movies to keep them socially connected with their peers.

Key words: COVID-19, infants, toddlers, peer interaction, social intelligence, mistrust,

shame

20C/SSC/019P

STATE FRAGILITY AND FORCED DISPLACEMENT IN NIGERIA

Soyombo Luke, Attoh Franca and Ilechukwu Victor

Department of Sociology, University of Lagos

shoyomboluke@yahoo.com

ABSTRACT

The paper explores the nexus between state fragility and forced displacement (IDPs) in Nigeria. Essentially, the paper is a theoretical prognosis of the existing causal channel and interaction between state fragility and forced displacement and uses secondary data from Fund for Peace (FFP) and Internal Displacement Monitoring Centre (IDMC) as an empirical approach for identifying causal pathways between these two phenomena. Theoretically, the paper is anchored on Marxist Theory of the State, Fineman's Vulnerability Theory and Giddens' Structuration Theory of Internally Displaced Persons. Data on State Fragility and Internally Displaced Persons (IDPs) from FFP and IDMC show that when the level of state fragility is high (90 and above), the level of Internally Displaced Persons (IDPs) will be high as well. From the foregoing analysis, it can be reasonably inferred that there is a nexus between state fragility and forced displacement (IDPs) in Nigeria. It is the submission of the paper that the incidence of forced displacement in Nigeria is a backlash to the failure of the social contract and the fragility of the Nigerian state. The paper concludes that forced displacement constitutes a serious social problem with deleterious effects on human security as well as social and economic development in fragile states as characterised by low state legitimacy, state ineffectiveness, socio-political turbulence and economic disarticulation. The paper recommends that issues of armed conflict, generalised violence, violation of human rights, human-made disasters, poverty, deprivation, underdevelopment, and bad governance should be adequately addressed by the Nigerian state.

Keywords: State fragility, forced displacement, internally displaced persons (IDPs), human security, social contract

LOCATIONAL ANALYSIS OF INFRASTRUCTURAL FACILITIES IN SELECTED OIL AND NON-OIL PRODUCING AREAS OF AKWA IBOM STATE

^{1*}Inyang M.U., ¹Soneye A.S.O., ²Okolie C.J., ¹Odunuga, S.S. and ²Onyegbula, J.C.

¹Department of Geography, University of Lagos, Akoka-Yaba, Lagos, Nigeria,

²Department of Surveying and Geoinformatics, University of Lagos, Nigeria
mbomabasi@gmail.com

ABSTRACT

The significance, efficiency and performance of infrastructural facilities is dependent on their geographical location. This study involves a locational analysis of infrastructural facilities in oil and non-oil producing areas in twenty rural communities of Akwa-Ibom State. Coordinates of infrastructural facilities were acquired with a handheld Global Positioning System (GPS). Thereafter, the locational analysis was carried out in the ArcGIS software environment in three stages: service area network analysis, infrastructure conformity assessment (circular buffer analysis) and location-allocation analysis (minimise impedance: nearest facility to demand). The results indicate that both the oil and non-oil producing areas are within the service area of educational and water facilities with each having seven communities within the commercial infrastructure service area. Most of the oil-producing areas were within the service area of health facilities while most of the non-oil producing areas were within the service area of small-scale industries. The infrastructure conformity assessment showed that 97% of infrastructures in the oil-producing areas were within the optimal location zones while 85% of infrastructure in non-oil producing areas were in the optimal location zone. Also, 21.3% and 17.6% of all infrastructures were closest to demand in the oil and non-oil producing areas respectively. This suggests an uneven allocation of infrastructural facilities between oil and non-oil producing areas with a higher percentage of oil-producing areas located in optimal zones serviced by infrastructural facilities. The possibility of operationalising the problems of coverage and optimally allocating scarce resources facing decision-makers in service development planning using location-allocation modelling was demonstrated in this study. The paper recommends enhanced infrastructure investment in areas outside infrastructure service areas and the use of location-allocation models in service provision to promote equity and spatial balance.

Keywords: Coverage, Geospatial analysis, Impedance, Location-allocation, Socio-economic Infrastructures

Cu²⁺ and Mn²⁺ DOPED ZnS NANOPARTICLES: SYNTHESIS AND OPTICAL CHARACTERISATION

¹Owoseni - Fagbenro K.A., ²Fasina T.M. and *¹Adams, L.A.

¹Materials and Nanochemistry Laboratory, Department of Chemistry, University of Lagos

²Inorganic Laboratory, Department of Chemistry, University of Lagos
fola186@yahoo.co.uk

ABSTRACT

Semiconductor fluorescence nanoparticles have become promising alternatives to organic fluorophore owing to their tunable fluorescence and high resistance to photobleaching. Currently, many of the available semiconductor fluorescence nanoparticles are inherently insoluble and/or highly carcinogenic to living systems e.g. cadmium-based semiconductor nanoparticles. Therefore, the investigation of fluorescence ZnS nanoparticles (ZnS NPs) with possibility of modifying the surface and optical properties through doping and ligand is apt to hydrophilic and biocompatible fluorescence nanoparticles. Herein, fluorescence ZnS nanoparticles (ZnS NPs) were prepared by colloidal synthetic route using Zn (NO₃)₂·6H₂O, Na₂S and mercaptopropionic acid (MPA) ligand as precursors. The influence of Cu²⁺ and Mn²⁺ as dopants on the fluorescence property of ZnS was evaluated. The as-prepared nanoparticles showed blue and pale green fluorescence under 365nm UV light and were further optically characterized using UV-Visible spectroscopy (UV-Vis) and Fourier transform infrared spectroscopy (FTIR). The UV-visible spectra of the ZnS NPs showed absorption maxima corresponding to blue shift in comparison with the bulk indicative of nano-sizing. FTIR revealed diagnostic bands corresponding to hydrophilic groups (O-H_{str}, C=O_{str}, C-O_{str} and C-S_{str}) which enhances their dispersibility in aqueous solution and also confirming effective interaction between the ligand and the NPs. It is instructive to note that the dopants Cu²⁺ and Mn²⁺ introduce new energy levels within the band gap, thereby, modifying the photophysical property of the ZnS NPs. Overall, the results herein suggest that the nanoparticles can be explored as potential materials for bioimaging application.

Keywords: Nanoparticles, ZnS, MPA, dopants, UV-Vis

**EVALUATION OF DIFFERENT VARIETIES OF MAIZE (*ZEAMAYS L.*) IN
BORNO STATE NORTHERN GUINEA SAVANNAH OF NIGERIA**

Samuel John Bwala

Department of Agricultural Technology
School of Science and Technology
The Federal Polytechnic Damaturu, Yobe State
sambwala93@gmail.com

ABSTRACT

An experiment was conducted at Biu LGA Borno state, Nigeria during 2019 rainy season to evaluate the effect of different variety on the growth and yield of maize (*Zea mays L.*). The experiment consisted of eight (8) variety of maize (E.V.D.T, D.M.R, Q.P.M, Gold seed, Oba 98, Sammaiz 14 Obar super 1, and Admiral Nyako) the treatments were laid out in a randomised complete block design {RCBD} and replicated four times. The plot size 3m×3m were used which give a total of 9m². Parameters assessed were plant height, number leaves, stem diameter, leaf area, number of line per cob, number of seed per cob, 100 seed weight, yield per plot, yield per hectare. The data collected were subjected to analysis of Variance (ANOVA) to test for variation of means among treatments. Duncan Multiple Range Test (DMRT) was used to separate the means. The result obtained showed that variety Q.P.M was significantly higher in plant height (154.77cm) number of leaves (15.49cm), stem diameter (7.82cm), leaf area (688.86cm) number of seed/line (14.79), yield per plot (g) (5.76) and yield per hectare (kg/ha) (5805.55) than all the treatments whereas the variety E.V.D.T had lower seed yield than all the treatment were tested. Based on the results of the study, it may be concluded that Q.P.M variety proved more promising in the study area.

Keywords: Maize, Borno State, seed, Guinea Savannah

**PHOTOVOLTAICS IN NIGERIA, VIABILITY AND SUSTAINABILITY BY THE
END OF 21ST CENTURY**

¹*Cecily O. Nwokocha, ²Ugochukwu K. Okoro and ¹Chizomam I. Usoh

¹Alvan Ikoku Federal College of Education Owerri, Nigeria.

²Imo State University Owerri, Nigeria.

¹Alvan Ikoku Federal College of Education Owerri, Nigeria.

cecily.nwokocha@alvanikoku.edu.ng

ABSTRACT

In contributing to alleviating energy issues in Nigeria, gaps such as Awareness, attitude and expected benefits of solar electricity, the awareness and information on PV penetration in Nigeria has been studied as they vary across locations. The objectives are to present contemporary information and statistics on the awareness of solar PV energy, the attitude towards utilizing PV resources and the expected benefits from PV energy resources using the Likert-scaled questionnaires as the primary data source. The reliability of the latent scales has been tested using Cronbach's alpha whereas the responses to the scale items have been analyzed using descriptive statistics. The identified epochs in the annual mean of the estimated Gh show more locations having a potentially significant level of increasing or decreasing trend from 2039 to 2098 than from 2006 to 2038 in both the RCP 4.5 and RCP 8.5 outputs respectively. This results present pointers in remediating PV energy challenges in Nigeria and are vital inputs to energy infrastructure planning, renewable energy investments, and national policy.

Keywords: Attitude, Awareness, Photovoltaic, Renewable energy

MICROBIAL AND SENSORY QUALITY OF PITO BEVERAGE TREATED WITH MORINGA SEED AND GINGER EXTRACT

¹Noah A.A and ²Alagamba. E.A

¹Department of Food Technology

² Department of Science Laboratory Tech.,

The Federal Polytechnic Ilaro, Ogun State, Nigeria.

adukechoix@gmail.com

ABSTRACT

Pito is a traditional brewed alcoholic beverage. Its processing is prone to microbial contamination which results to poor shelf life. The present work investigated the microbial analysis of Pito beverage produced from sorghum treated with varying concentration of Moringa seed and ginger extract as preservatives. Standard microbiological method was used. The result of microbiological analysis shows that the Total plate count for the first day ranged from 3.0×10^2 to 14.0×10^2 cfu/ml and for the 7 days of storage, it ranged from 2.5×10^2 to 6.0×10^2 cfu/ml while *Staphylococcus* Count ranged from 4.5×10^2 to 0.5×10^2 cfu/ml on the first day with no growth on the 7 day. The fungi count of the samples was varied from 10.5×10^2 to 2.5×10^2 cfu/ml during the 0 day and 8.0×10^2 to 4.0×10^2 cfu/ml during 7 days storage for sample. Generally, there was reduction in the microbial growth as storage proceeds in the treated samples with the control sample having the highest growth on both the 0 & 7 days while no Coliform growth on both 0 & 7 days of analysis in all the treated samples. Sensory evaluation depicts that the result of Overall-acceptability varied from 6.60-8.30 with significant difference ($p < 0.05$) across all samples. The sample with ratio (90:5:5) was most preferred among the treated samples as the proportion of Moringa seed and ginger extracts increases in terms of overall-acceptability. Hence, Moringa and ginger have reduced the microbial count thereby improving the shelf life of pito and organoleptic properties thus its inclusion should be encouraged.

Keywords: microbial, sensory, quality, pito, beverage.

**TUNABLE FLUORESCENCE CARBON NANOPARTICLES: MORHOLOGICAL
AND OPTICAL CHARACTERISATION**

¹Fagbenro-Owoseni K.F.,¹Fasina T.M.,²Olopade M.I.A.,³Shah M. R. and ^{1*}Adams L.A.

¹Department of Chemistry, University of Lagos, Nigeria

²Department of Physics, University of Lagos, Nigeria

³H.E.J. Research Institute of Chemistry, International Center for Chemical and Biological
Sciences, Karachi University, Pakistan

ladams@unilag.edu.ng

ABSTRACT

Fluorescence carbon nanoparticles (CNPs) have intriguing properties such as strong luminescence and biocompatibility among others which makes them suitable replacement to traditional semiconductor nanoparticles (Quantum dots) for therapeutic and diagnostic imaging applications. Currently, most of the available CNPs emit blue light under Ultraviolet (UV) excitation. Bio-tissues and cells also emit blue light under UV light, therefore obtaining CNPs with long emission wavelength is apt for enhanced imaging. Herein, tunable fluorescence carbon nanoparticles were prepared by acid mediated thermal carbonization of some biomass and folic acid. The effect of temperature, composition and carbon source on the fluorescence property of the nanoparticles were investigated. The as-prepared carbon nanoparticles were characterized by UV-Vis, Fourier transform infrared spectroscopy (FTIR), Atomic force microscopy (AFM) and fluorimeter. FTIR analysis confirms bands that confer hydrophilicity and evidence of doping by P and S atoms present in acid. UV-Vis spectra showed characteristic absorption peak for CNPs corresponding to $n \rightarrow \pi^*$ transitions. AFM analysis revealed nanoparticles with spherical morphology. The CNPs showed strong blue, green and yellow colours with emission max centered at 576 nm. The size and or composition controlled effects were evident from the different excitation dependent emissions observed in the fluorescent spectra. The results suggest that the fluorescent carbon nanodots materials can be explored as potential diagnostic agents in imaging.

Keywords: Carbon nanoparticles, Biomass, Fluorescence, Tunable, Bioimaging

**DIVERSITY OF BACTERIA IN THE GUT AND SKIN OF HOUSE WALL GECKOS
(HEMIDACTYLUS FRENATUS)**

Omotayo A.E. and Durojaiye A.R.

Department of Microbiology, Faculty of Science, University of Lagos, Nigeria
aomotayo@unilag.edu.ng, adetibaprecious@yahoo.com

ABSTRACT

It is known that animals maintain complex associations with diverse microbiota living in their guts and their skin. This work investigated the bacterial composition of the gut and skin of wall geckos (*Hemidactylus frenatus*). The samples from the geckos were cultured on different nutrient media. The isolates were biochemically identified and subjected to susceptibility tests. The population density on the different culture media ranged between 0 – 1.02×10^8 CFU/g. Seventy- one (71) bacterial isolates were realised from both gut and skin samples of 20 geckos (8 males and 12 females). There were 33 Gram-positives and 38 Gram-negatives belonging to 14 genera; *Staphylococcus*, *Bacillus*, *Listeria*, *Corynebacterium*, *Shigella*, *Yersinia*, *Klebsiella*, *Pseudomonas*, *Salmonella*, *Serratia*, *Enterobacter*, *Citrobacter*, *Escherichia* and *Proteus*. *Staphylococcus* spp. (33.79%) had the highest prevalence followed by *Pseudomonas* spp. (15.45%) and *Salmonella* spp. (9.86%). Male wall geckos showed a higher abundance of bacteria (56%) than the females (44%). The gut bacterial diversity (63%) was more than the skin (37%). The Gram-positive bacteria showed 100% resistance to Gentamicin (30 µg/disc) and Vancomycin (30 µg/disc) with varying susceptibility to other antibiotics tested. The Gram-negative bacteria showed a 100% resistance to Aztreonam (30µg/disc), Cefotaxin (30µg/disc) and Rampicin (5µg/disc), with a 100% susceptibility to Meropenem (10µg/disc). This study showed that geckos are carriers and reservoir of pathogenic bacteria.

Keywords: Contamination, geckos, reptiles, bacteria, gut, skin.

**GENOTYPIC ASSESSMENT OF TWO *BACILLUS MEGATERIUM* STRAINS FOR
POLY-3-HYDROXYALKANOATES SYNTHESIS BY QUANTITATIVE REALTIME
PCR**

***Fadipe T.O., Akadiri O.O., Baruwa A.S., Alebiosu F.A., Ibidapo O.I., Kolawole T.O.,
Ehiwuogu-Onyibe J. and Lawal A.K.**

Biotechnology Department, Federal Institute of Industrial Research, Oshodi, 100261, Lagos,
Nigeria.

*topesalaam@gmail.com

ABSTRACT

Poly-3-hydroxyalkanoates (PHAs) are carbon and energy intracellular polymers made and accumulated by several bacteria under environmental stress induced by unbalanced growth conditions. They have been intensively studied and are of global commercial interest because of their potential use in biodegradable plastic production. We report findings from the use of real-time PCR as a tool for the genotypic selection of an hyperproducing bacteria with potential for sustainable PHAs production. Two *Bacilli* strains, FD31a and FR9b, obtained from the Culture bank of the Biotechnology Department in the Federal Institute of Industrial Research, Oshodi were used in this research. The *Bacilli* strains were refreshed on nutrient agar and further characterised by 16SrRNA sequencing. The class of PHA synthase gene (*phaC*) present in the isolates was confirmed by polymerase chain reaction (PCR) using selected primers for *Bacillus* species. The expression of *phaC* gene was determined by real-time PCR in order to select the better PHA producer. Both bacteria were identified as *Bacillus megaterium* strains. *B. megaterium* FD31a (MN533710) shared closest homology with *B. megaterium* ATCC 14581 at 99 % identity while *B. megaterium* FR9b (MN533711) had closet homology with *B. megaterium* NBRC 15308at 98 % identity. They were determined as class IV PHA producers and their partially amplified *phaC* gene sequences have been accessioned in the NCBI GenBank as MN503476 and MN503477 for *B. megaterium* FD31a and *B. megaterium* FR9b, respectively. The mean expression values of the *phaC* gene in *B. megaterium* FR9b was 1.155 ± 0.003 while *B. megaterium* FD31a was 1.105 ± 0.002 , these values are statistically significant at $p < 0.05$. Based on the expression of *phaC* gene, *B. megaterium* FR9b is selected as the better performing strain for commercial

PHAs production. This study showed that real-time PCR can be a powerful tool for selecting hyperproducing bacteria for industrial biotechnological processes.

Keywords: *Bacillus megaterium*, Gene Expression, Poly-3-hydroxyalkanoates Synthase, Bio-polyesters, Realtime PCR

20C/SCI/008P

ASSESSMENT OF IRON STATUS: MARKERS OF INFLAMMATORY AND IMMUNE RESPONSE IN SCHOOL AGE CHILDREN

¹*Quadri J.A., ²Onabanjo O.O. and ¹Ojure M.A.

¹ Department of Nutrition and Dietetics, Ogun State College of Health Technology, Ilese-Ijebu, Ogun State, Nigeria.

²Department of Nutrition and Dietetics, Federal University of Agriculture Abeokuta, Ogun State, Nigeria.

olaquadri2004@yahoo.co.uk

ABSTRACT

Iron deficiency is a public health problem based on the seriousness of its consequences on human health. This study assessed iron status, markers of inflammatory and immune functions of rural and urban school age children in selected Local Government Areas (LGAs) of Ogun state. A multistage sampling technique was used to select three hundred and twelve school age children from the three senatorial districts. A validated questionnaire was used to obtain information on socio-economic characteristics. Blood samples were analyzed for biochemical parameters and selected immune function markers (CD4, white blood cell differentials) were also measured using standard procedures. Data were analyzed using frequency counts, percentages, means, standard deviations, correlation. Results showed that 30.5% of the respondent families earned less than two hundred thousand naira annually. Also, 19.9% of the mothers in the rural sector had tertiary education. The study revealed the prevalence of iron deficiency to be 23.7%, anaemia was 16.3% while 13.1% of the anaemic children were due to iron deficiency anaemia. The result of the CRP showed a high risk in 13.8% and CD4 count was low in 16.7% of the children. Haemoglobin correlated positively with age ($r = 0.144$) and average annual income of the family ($r = 0.132$), serum ferritin correlated positively with mothers age and household size ($r = 0.159$; $r = 0.030$). CRP positively correlated with annual income ($r = 0.155$). CD4 positively correlated with mothers

age and education ($r = 0.252$; $r = 0.142$). Conclusively, significant relationship exists between socio economic and iron status ($p < 0.05$) as well as the rate of inflammation and immune response in the children. Hence, Appropriate investigations for iron status and inflammation/infection screening, need to be integral in the evaluation of anaemia and its causes before anaemia control interventions are implemented.

Keywords: Immune, Inflammation, Anaemia, Reticulocyte

20C/SCI/009P

OUTDOOR AND INDOOR AIR QUALITY OF THE UNIVERSITY OF LAGOS, AKOKA CAMPUS, AT THE ONSET OF COVID-19

***¹Alani Rose, ¹Ayejuyo Olusegun, ²Odunuga Shakirudeen, ¹Seyinde Doris, ²Ogunbiyi Temitope, ¹Ekpo Imaobong, ¹Ogbeni Princewill, ¹Isumomodu Abdulrauf, ¹Ajayi Olumide, ³Okolie Chukwuma and ⁴Okwong Walter**

¹Chemistry Department, Faculty of Science, University of Lagos, Nigeria

²Department of Geography, Faculty of Social Sciences, University of Lagos, Nigeria

³Department of Surveying and Geoinformatics, Faculty of Engineering, University of Lagos, Nigeria

⁴Department of Botany, Faculty of Science, University of Lagos, Nigeria

*ralani@unilag.edu.ng

ABSTRACT

This paper investigates the levels of outdoor and indoor air quality of the Akoka campus of the University of Lagos at the onset of COVID-19 during the first quarter of the year 2020. This was the period that the University dumpsite went into flames which could result in the emission of toxic substances to the air from the burning of plastics and other materials. Real time data collection was carried out for nitrogen dioxide (NO₂), sulphur dioxide (SO₂), particulate matters (PM₁, PM_{2.5}, and PM₁₀) for 30 minutes each at eleven outdoor locations (L1 –L11) and seven indoor locations (S1-S7) in the campus using a sensing device, Air Quality Egg (AQE) on 6th and 7th February 2020 (dry season) and 13th March 2020 (rainy season). During the dry season outdoor air monitoring, the highest concentrations of PM₁, PM_{2.5}, and PM₁₀ of 70.82µg/m³, 122.09 µg/m³ and 136.13µg/m³ respectively were found at location L3 while the lowest PM₁, PM_{2.5}, and PM₁₀ of 41.64 µg/m³, 65.09µg/m³, and 74.45µg/m³ were found at location L4; the highest SO₂ (3698.90 µg/m³) was found at location L1 while the lowest (520.83 µg/m³) was at L5; the highest NO₂ (1239.33 µg/m³) was found at location L4 while the lowest (872.7231 µg/m³) was at L7. PM_{2.5} at all locations exceeded the WHO limit of 20 µg/m³. PM₁₀ at almost all locations exceeded the WHO limit

of 30 $\mu\text{g}/\text{m}^3$. For NO_2 and SO_2 almost all locations exceeded the WHO limit of 200 $\mu\text{g}/\text{m}^3$ and 500 $\mu\text{g}/\text{m}^3$ respectively. Pollutants levels were generally lower during the rains, except for SO_2 at few locations. Comparing the outdoor and indoor pollutants concentrations, more locations indoor had higher concentrations than outdoor. The outdoor and indoor air quality of the University of Lagos, Akoka campus, at the onset of COVID-19 pandemic is hereby presented as very unhealthy.

Keywords: Air quality, Particulate matters, Sulphur dioxide, Nitrogen dioxide, COVID-19 onset, University of Lagos.

20C/SCI/010P

**PHYTOCHEMICAL, PROXIMATE AND ANTIDIABETIC INVESTIGATION ON
SYNSEPALUM DULCIFICUM FOR MANAGEMENT OF DIABETES MELLITUS IN
NIGERIA**

¹*Onuminya T.O., ¹Ifelaja F.M., ²Asekunowo A.K. and ¹Ogundipe O.T.

¹Department of Botany, Faculty of Science, University of Lagos, Nigeria

²Department of Chemistry Faculty of Science, University of Lagos, Nigeria

* tadeyemi@unilag.edu.ng

ABSTRACT

Medicinal plants have been useful in folk medicine in treatment and management of ailments including diabetes. Ethnobotanical record shows that *Synsepalum dulcificum*, a potent natural sweetener, has been employed in the treatment of Diabetes mellitus in Nigeria. In this study, the phytochemical, proximate composition and hypoglycaemic potential of aqueous and ethanol extracts of the leaves and stem of *S. dulcificum* were investigated using standard protocols. *In-vivo* assay protocols on alloxan-induced diabetic albino rats was followed in determining the hypoglycemic potentials of the extracts (concentrations: 100 mg/kg, 200 mg/kg, 400 mg/kg), and glibenclamide as standard drug. The results revealed that aqueous leaf extract had a higher yield (19.67%) compared to the ethanolic extract (17.15%). Phytochemical analysis revealed the presence of flavonoids, saponins, terpenoids, tannins, phenols, steroids, cardiac glycosides and alkaloids in varying degrees in the plant parts. Proximate analysis showed higher lipid (23.30%) and protein (12.94 %) in leaves and higher fibre content in stem (30.00 %). The aqueous leaves extract at high dose (400 mg/kg) gave the best glucose lowering effect (66.67 mg/dL) of all the extracts tested. The albino rats were unable to survive the lower dose (100 mg/kg) of all the extracts. The observed hypoglycemic

effect of aqueous leave extract may be linked to significant tannins, flavonoids and saponin in the extract, as these phytochemicals have been reported to exhibit blood sugar lowering potentials. The results from this study confirmed the leaf aqueous extract as potential anti-diabetic agent and justified the use of *Synsepalum dulcificum* in management of hypoglycaemia in Nigeria.

Keywords: *Synsepalum dulcificum*, medicinal plants, hypoglycaemia, Phytochemistry, Ethnomedicine

20C/SCI/011P

THE MIGRATION OF PHTHALATE ESTERS IN POLYETHYLENE TEREPHTHALATE (PET) PACKAGED WATER AT DIFFERENT STORAGE AND ENVIRONMENTAL CONDITIONS IN LAGOS METROPOLIS

Ekwealor C.I., *Oyeyiola A.O., Fatunsin O.T. and Olayinka K.O.

Department of Chemistry, University of Lagos, Akoka
aoyeyiola@unilag.edu.ng

ABSTRACT

The demand for potable drinking water in Nigeria is met by production, marketing and consumption of water packaged in polyethylene terephthalate bottles and sachets. In Lagos State, up to 70% of the population depend on packaged water for drinking and this has led to concerns about the migration of phthalate esters into packaged water. This study investigates the concentration of phthalate esters in packaged drinking water in Lagos Metropolis. It also investigates the effect of storage time and environment conditions on the amount of these esters leached into the waters. Water samples were collected from factories as soon as they were produced and stored for different days. The samples were also stored at different environmental conditions (Refrigerated: 4-8°C, indoor; 23-27°C, and outdoors; 31 - 33°C) for one to four weeks. Phthalates esters were extracted using Liquid- liquid extraction with dichloromethane and cleaned up using Solid phase extraction (SPE) reversed phase. Quantification was with an Agilent 6890 Gas Chromatograph with Flame Ionization detector (GC-FID) fitted with HP-5 Capillary column. Five (5) phthalate esters: dimethyl phthalate (DMP), diethyl phthalate (DEP), dibutyl phthalate (DBP), benzyl butyl phthalate (BBP) and di (2-ethylhexyl) phthalate (DEHP) were detected in the packaged waters. DEHP was the most dominant phthalates detected in the drinking water samples. Increase in concentration of DBP, BBP and DEHP stored at different environmental conditions was observed to be in the

order DBP < BBP < DEHP with DEHP reaching a maximum concentration of $7.35 \pm 0.09 \mu\text{g/L}$ and $7.76 \pm 1.01 \mu\text{g/L}$ for sachet and bottled water respectively for outdoor storage (31-33°C). Maximum concentrations obtained for DEHP was found to be slightly above the United States Food and Drugs Administration Maximum Contaminant Level (MCL) for DEHP in drinking water which is $6 \mu\text{g/L}$. Given the effect of DEHP, good storage practices at shorter storage time should be practiced in order to mitigate the potential leaching of phthalates from PET sachets and bottles to water. This will help in reducing human daily intakes of phthalates through water consumption, especially to the vulnerable populations such as neonates, infants, and pregnant women.

Keywords: Packaged Water, Phthalate Esters, Polyethylene Terephthalate, Sachet water

20C/SCI/012P

OBSERVABLE COMPLIANCE AND DEFIANCE TO COVID-19 PREVENTIVE MEASURES IN LAGOS: PROVISIONS AND IMPLICATIONS

Adelowotan Aminat Oluwatoyin, Adesida A. Solayide and Ayolabi Chritianah Idowu

Department of Microbiology, Faculty of Science, University of Lagos

aadelowotan@unilag.edu.ng

ABSTRACT

Corona virus infectious disease (COVID-19), a global pandemic was first reported in Lagos State, the epicenter in Nigeria. Nigeria Centre for Disease Control (NCDC) reported that eleven of the twenty local government areas (LGAs) that accounted for 60% of the cases in Nigeria were in Lagos State which adversely affected people's lifestyles, livelihood and many lives lost. Imposed lockdown in April 2020 that was eased in May allowed opening of businesses with instructions on prevention through hand hygiene, physical distance and face masking in public according to the WHO and NCDC directives. Many observed the instructions while others do so shoddily to avoid arrest/penalties or disobey with claims that COVID-19 was a ruse. This study was aimed to assess the compliance and defiance of people to prevention directives. Direct observation data on compliance of adults and children of both genders to hand hygiene, face masking and physical distancing were collected at 100 randomly selected sites from 8 LGAs with reported high and low prevalence using ethically approved form. A group of 4-10 persons per group interacting in public were observed for 30min. Observable provisions available for compliance were also reported for each site. Compliance was compared to preventive standards from official NCDC and Lagos

state websites. Data showed equivocal more defiance than compliance by persons at all sites. More than 70% of adults did not use face masks or left them hanging under the chin while the few children sampled were unprotected. Physical distancing was non-existence and observable hand hygiene was less than 20%. Neither compliance nor defiance was dependent on disease prevalence in the LGA sampled. Provisions for and enforced compliance existed in many institutions and few small business areas. Highest defiance was observed on the streets and public markets. In the coming months as schools and religious places open, more compliance should be encouraged and enforced.

Key words: COVID-19, Prevention, Compliance, Lagos

20C/SCI/013P

**MOBILITY, SPATIAL VARIATION AND HUMAN HEALTH RISK ASSESSMENT
OF MERCURY IN SOIL FROM ALABA E-WASTE RECYCLING SITE, LAGOS,
NIGERIA**

^{1,4}Anselm O.H., ²Cavoura O., ³Davidson C.M., ¹Oluseyi T.O., ^{1*}Oyeyiola A.O. and
⁵Togias K.

¹ Department of Chemistry, University of Lagos, Akoka, Lagos, Nigeria.

²Department of Public Health Policy, School of Public Health, University of West Attica,
Greece

³WestCHEM, Department of Pure and Applied Chemistry, University of Strathclyde,
Glasgow, UK

⁴Department of Chemical Sciences, Tai Solarin University of Education, Ijagun, Ogun State,
Nigeria.

⁵Department of Sanitary Engineering and Environmental Health, National School of Public
Health, Athens, Greece.

*aoyeyiola@unilag.edu.ng

ABSTRACT

Informal recycling of e-waste is of environmental concern because of the exposure of humans to potentially toxic elements such as mercury(Hg). However, the total concentration of mercury is not an indication of its toxicity rather this can be assessed by determining its mobility. This paper seeks to determine the spatial variations and mobility of mercury in soil samples collected from Alaba, the largest e-waste recycling site in Nigeria and West Africa. Total Hg concentration was determined in surface soils samples from various locations using Cold Vapour Atomic Absorption Spectrometry (CVAAS) following microwave assisted acid

extraction, while sequential extraction was used to determine operationally defined mobility. Total Hg concentration ranged from <0.07 to 624mg/kg and was largely dependent on the nature and intensity of e-waste recycling activities carried out. Mobile forms of Hg, which may be HgO (a known component of some forms of e-waste) accounted for between 3.2 and 23% of the total Hg concentration and were observed to decrease with increasing organic matter (OM). Non-mobile forms accounted for >74% of the total Hg content. Hazard quotient values >1 at two locations suggest that Hg may pose health threats to people working at the e-waste recycling site. It is therefore recommended that hair or blood samples of workers should be investigated for symptoms of Hg exposure.

Keywords: e-waste, recycling, mercury, mobility, risk assessment

20C/SCI/014P

PRESENCE AND SELECTIVE UPTAKE OF PHARMACEUTICAL IN FISH SPECIES FROM THE LAGOS LAGOON SUBJECTED TO SEWAGE DISPOSAL

^{1,2*}**Idera Fabunmi, ¹Natalie Sims, ¹Kathryn Proctor, ²Aderonke Oyeyiola, ²Temilola Oluseyi, ²Kehinde Olayinka, ¹Barbara Kasprzyk-Hordern**

¹Department of Chemistry, University of Bath, Bath BA2 7AY, UK

²Department of Chemistry, University of Lagos, Lagos, Nigeria

* ideragaffar@yahoo.com

ABSTRACT

The continuous release of pharmaceuticals into the aquatic environment has raised concerns about the effect of sewage disposal on the health of aquatic organism and man. Increasing evidence shows prevalent occurrence of drugs in urban discharges and surface waters. This study investigates the presence of pharmaceuticals and their selective uptake in commonly found fishes in the Lagos Lagoon using Ultrasonic Assisted Extraction (UAE) and the Ultra-High Performance Liquid Chromatography tandem Mass Spectrometry (UHPLC- MS/MS) for quantification. Thirty-six compounds were analysed in seven fish species; sole (*Cynoglossus senegalensis*), tilapia (*Tilapia zilli*), grouper (*Epinephelus aeneus*), catfish (*Synodontus clarias*), silver catfish (*Chrysichthys nigrodigitatus*), croaker (*Pseudotolithus senegalensis*) and red snapper (*Lutjanus agennes*) from the Lagos Lagoon. Results only showed that three compounds; fluoxetine (antidepressant), trimethoprim (antibiotic) and tramadol (analgesic) were present in the fish samples. Fluoxetine and trimethoprim were detected at concentrations above Method Quantification Limits (MQLs) while tramadol was

found below MQL in muscles, gills and eyes of fish samples. Though Octanol/Water Partition Coefficient (K_{ow}) > 5 is an important factor for bioaccumulation of drugs in aquatic organisms, compounds detected had K_{ow} < 5. This suggests that uptake of pharmaceuticals by fish is a complex process and is influenced by many factors.

Keywords: Pharmaceuticals, fish, UAE, UHPLC- MS/MS

20C/SCI/015P

BACTERIAL PRODUCTION OF LIPASE FROM WILD-TYPE *BACILLI* BY SOLID STATE FERMENTATION

¹*Baruwa, A.S., ²Fadipe T.O., ¹Okonji R.E. and ¹Obuotor E.M.

¹Biochemistry and Molecular Biology Department, ObafemiAwolowo University, Ile-Ife, Nigeria.

²Biotechnology Department, Federal Institute of Industrial Research, Oshodi, Lagos, Nigeria.

* abayomi.baruwa@gmail.com

Abstract

Lipases (triacylglycerol acylhydrolase EC 3.1.1.3) are versatile enzymes with multiplexity of catalysis and therefore constitute an important class of industrial enzymes in basic and applied research. They are part of the serine hydrolase family that acts on carboxylic ester bonds of triglycerides. The research focused on the selection of a hyper producing bacteria with potential for sustainable lipase production. The lipase-producing bacteria species were isolated from vegetable oil processing site soil from Daleko market, Lagos, Nigeria. Isolation of bacteria from soil samples was carried out on nutrient agar using the serial dilution / pour plate technique. The isolates were screened for zone of hydrolysis at 37°C after 24 hours (overnight) of growth using phenol red agar that contained olive oil as the only source of carbon. Thereafter, lipase was produced using nine strains in a fermentation medium containing rice bran, mineral water and waste frying oil followed by lipase extraction and activity assay. The strain which gave the highest activity was selected as lipase hyper-producer. A total of 47 isolates were obtained from vegetable oil processing site soil. Colonial and cellular morphologies revealed the isolates as gram positive bacteria, *Bacillus* sp. Seventeen isolates had significant zone of hydrolysis. Isolate D210³11 gave the largest zone of hydrolysis (4.0 cm) while isolate D210⁴16 gave the lowest zone of hydrolysis (1.8

cm). However, isolate D210³⁵ had the highest lipase activity of 4.60 ± 0.27 $\mu\text{mol/ml/min}$ and hence is selected as lipase hyper-producer. The study showed isolate D210³⁵ as a promising bacterium for sustainable lipase production useful in industrial processes.

Keywords: Isolate, *Bacillus sp.*, lipase, fermentation, industrial enzyme.

20C/SCI/016P

**DETERMINATION OF CYCLIC VOLATILE METHYLSILOXANES IN WATER,
SEDIMENT AND BIOTA: AN ASSESSMENT OF HUMAN AND
ENVIRONMENTAL EXPOSURE**

***Aderonke O. Oyeyiola, Oluwatoyin T. Fatunsin, Idayat K. Akinwale, Adenike A.
Akinsanmi**

Department of Chemistry, Faculty of Science, University of Lagos, Nigeria

* aoyeyiola@unilag.edu.ng

ABSTRACT

Siloxanes are commonly used in cosmetics and personal care products, health care products and many industrial applications. Due to their persistence, volatility and bio-accumulative property, they have been recognized as threat to our environment. The aim of this research is to determine the presence of some cyclic volatile methylsiloxanes (Octamethylcyclotetrasiloxane D4, Decamethylcyclopentasiloxane D5, Dodecamethylcyclohexasiloxane D6) in the Lagos environment. Sludge of cosmetics waste-treatment plants (Ikeja, Ijora cause-way, Apapa and Yaba in Lagos), receiving waters, sediments and fish samples collected from three different parts of the lagoon in Lagos State (Makoko, Oworonshoki and Iddo rivers). Some physicochemical analyses were carried out on the sludge and water sample using standard methods. Methylsiloxanes were extracted from samples by ultrasonic extraction Tetrakis(trimethylsiloxyl)silane as the internal standard and Naphthalene-d8 as the recovery standard prior to the GC-MS analysis. The sludge samples had an average pH, conductivity and moisture content of 8.3, 2.1 $\mu\text{S/cm}$ and 97.92% respectively while the water samples an average pH, conductivity and total dissolved solids of 8.4, 11.2 $\mu\text{S/cm}$ and 1 mg/L. Sediment samples had an average moisture content and total organic carbon of 16.5 % and 2.53% respectively, while the fish samples contained an average of 70.9% and 1.11% moisture and lipid content respectively. Methyl siloxanes were detected in all the samples at varying concentrations. The concentration of D4, D5 and D6 in this study were between 0.341 and 138 ppb, 12.5 and 330 ppb and 12.5 -178 ppb

respectively. This study showed that these emerging contaminants are present in every aspect of the aquatic environment and measures must be put in place to check their increase in the environment.

Keywords: Cyclic Volatile Methylsiloxanes, Octamethylcyclotetrasiloxane, Decamethylcyclopentasiloxane, Dodecamethylcyclohexasiloxane

20C/SCI/017P

EFFECT OF SODIUM HYPOCHLORITE IN TRIPLOID INDUCTION IN *Clarias gariepinus* FOR WILD WATERS STOCKING, CONSERVATION AND MANAGEMENT

Olayimika, Solomon O. A.

Department of Water Resources, Aquaculture and Fisheries Technology School of Agriculture and Agricultural Technology. Federal University of Technology Minna, Niger
State seideolayimika@gmail.com; horseford2000@yahoo.com

ABSTRACT

Nigeria wild waters are being depleted of *Clarias gariepinus* due to fishing pressure without the ability to replenish itself, thus necessitates intervention by stocking sterile *Clarias gariepinus*. Determination of optimum dosage and duration for treatment that will lead to triploidisation of *Clarias gariepinus* will make wild water stocking realistic. Eggs were artificially fertilised, and subjected to 1.0 % sodium hypochlorite (10,000 ppm) treatments five (5) minutes after fertilisation at varied dosages of 1 ml/l, 2 ml/l and 3 ml/l for 5, 10, 15, and 20 minutes then incubated at 28 ± 1 °C for 24 hours. The fertilised eggs treated and untreated were compared for survival and hatchability. Water quality parameters taken are within the acceptable range: Temperature (25.5-26°C), dissolved oxygen (6.04mg l⁻¹-6.50mg l⁻¹), conductivity (300-320µs) and pH (6.40- 7.00). 1.0 % sodium hypochlorite (10,000 ppm) at dosages of 1 ml/l, 2 ml/l and 3 ml/l for periods of 5, 10, 15 and 20 minutes significantly affected fertilised eggs ($P \leq 0.05$), as dosages of treatments increased, fertilised eggs survival and hatchability decreased. Treatment with dosage 1 ml/l at duration of 5 minutes produced better fertilization and hatchability compared to other dosages. The expected sterile fishes can be used in stocking wild water bodies to increase availability without genetic pollution, reduce endangerment and leading to effective management.

Keywords: Sodium hypochlorite, Fertilized eggs, Triploid, Chemical shock, Duration

EFFECT OF THERMAL (30 °C) ON THE APPLICATION OF YEAST AS A BIOTECHNOLOGICAL TOOL IN THE IMPROVEMENT OF RICE BRAN AS A FISH FEED INGREDIENT

Olayimika S.O.A.

Water Resources, Aquaculture and Fisheries Technology Department,
Federal University of Technology, Minna; Niger State.

olayimikasolo@gmail.com; seideolayimika@gmail.com; solo.olayimika@futminna.edu.ng

ABSTRACT

Ingredients cost is a major factor affecting the cost of feed and fish production. Rice bran is a waste produced from rice. Several treatment methods (physical, heat, enzymic and chemical) have been used in the extraction of protein from Rice bran. Determination of appropriate dosage of Yeast at 30°C that improves nutrient availability in Rice bran necessitate this study. Rice bran nutrient composition was determined using proximate analysis (Crude protein - 7.75 % and crude fibre - 26.89 %.Yeast (*Saccharomyces cerevisiae*) was applied by evenly mixing yeast (0 %, 3 %, 4 % and 5 %) into rice bran and adding water to it, then digested at 30°C. Crude protein increased after digestion to 10.06 %, 11.38 % and 9.63 % while crude fibre reduced to 19.05 %, 21.08 % and 21.89 % after digestion with 3 %, 4 % and 5 % application respectively. Application of 4 % yeast produced the highest protein, while 3 % produced the least crude fibre. Digestion of rice bran with yeast as a biotechnological tool will increase available and digestible nutrients, thus reduced cost of feed and fish production.

Keywords: Yeast, Digestion, Crude Protein, Crude Fibre and percentage

MICROBIOLOGICAL, PHYSICOCHEMICAL, NUTRITIONAL AND ANTI-NUTRITIONAL EVALUATION OF LOCALLY MADE NON-ALCOHOLIC KUNUN ZAKI BEVERAGE SOLD IN LAGOS STATE, NIGERIA

¹*Ogunyemi Bukola Caroline, ²Ogunyemi Adewale Kayode, ³Odetunde Simeon Kolawole, ⁴Adesola O. Olalekan, ¹Ariyo Ademola, ¹Ativie Faith, ¹Okoh Chinedum, ¹Osuji Mirian, ⁵Akinyemi K. Olusegun, ⁶Iwalokun Bamidele Abiodun

¹Department of Chemical Sciences, Yaba College of Technology, Yaba, Lagos, Nigeria.

²Department of Microbiology, University of Lagos, Lagos, Nigeria.

³Department of Science Laboratory Technology, Microbiology Unit, Lagos State Polytechnic, Ikorodu, Lagos. ⁴Molecular Biology and Biotechnology Unit, Department of Medical Laboratory Science, College of Medicine. University of Lagos.

⁵Department of Microbiology, Lagos state University.

⁶Molecular Biology Division, Nigerian Institute of Medical Research (NIMR), Yaba, Lagos, Nigeria.

* bukolaalagbada@gmail.com

ABSTRACT

Kunun zaki is a traditionally fermented cereal-based beverage produced locally and generally consumed throughout Nigeria. This study aimed to evaluate the microbiological quality, physicochemical, nutritional and anti-nutritional content of kunun zaki samples sold in various markets in Lagos, Nigeria using standard methods. The total bacteria and coliform count in kunun zaki ranged from 12×10^6 to 39×10^6 cfu/ml for bacteria and 3×10^5 to 17×10^5 cfu/ml for coliform respectively, while mould and yeast had total counts of 5×10^4 - 19×10^4 cfu/ml and 1.0×10^4 - 9×10^4 cfu/ml respectively. The predominant bacterial species isolated were *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella* sp., *Bacillus* sp. *Streptococcus* sp., *Citrobacter freundii* and *Pseudomonas aeruginosa*. The predominant fungal species isolated from the samples were *Fusarium* sp., *Aspergillus parasiticus*, *A.niger*, *Candida albicans*, *Penicillium* sp. and *Saccharomyces cerevisiae*. *Bacillus subtilis* (27.14%) had highest occurrence while *Citrobacter freundii* had the least occurrence (5.71%). Also, *Saccharomyces cerevisiae* (61.72%) had the highest occurrence while *Penicillium* sp. had the least occurrence (1.23%). The pH and titatable acidity of the samples ranged from 3.87 to 4.28 and 0.18 to 0.43 g/L, respectively while the specific gravity ranged from 0.736-0.75. The proximate analysis also showed that samples contained 0.3-0.6% protein, 0.4-1.1% fat, 1.3-1.62 ash and 12.8-20.4% carbohydrate with moisture content ranging from 76.75-84.45. The results for the mineral content analysis in mg/100g showed that the presence of Phosphorus (176.4-278), Calcium (290.7-427.2), Potassium (155-203), Copper (0.1-0.9), Manganese (0.4-1.5) and Magnesium (90.2-112.8). The phytate content and trypsin inhibitor of the samples reduced from 0.093mg/100g to 0.27mg/100g and 0.058mg/100g-0.081mg/100g, respectively. This study showed that the Kunun zaki samples obtained from

different markets in Lagos, Nigeria were grossly contaminated with pathogenic microorganisms which pose threats to public health and wellness.

Keywords: Kunun zaki, physicochemical, proximate, mineral, anti-nutritional, microbiological

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COMPARISON OF SUCROSE AND GLUCOSE AS CARBON SOURCES FOR THE GROWTH OF *MORINGA OLEIFERA* LAM. EMBRYOS *IN VITRO*

¹Okafor U.C., ^{1,2}*Adeosun C.A., ¹Njoku E.U., ¹Nwokeke C.V.

¹Department of Plant Science and Biotechnology, University of Nigeria, Nsukka.

²Department of Botany, University of Ibadan, Ibadan.

* chidiebere.adeosun@unn.edu.ng

ABSTRACT

Moringa oleifera Lam. is one of the nutritious and medicinal plants known and its micropropagation has been adopted over time to aid its availability to man. Irrespective of the knowledge on species-specific carbon source in micropropagation, there is dearth of information on the proper carbon source and concentration for *Moringa oleifera* explants especially the embryo culture hence the need to determine the optimal carbon source for better growth of the plant *in vitro*. The embryo of *Moringa oleifera* was cultured *in vitro* using sucrose and glucose as carbon sources at two different concentrations to check the effect of the different carbon sources and concentration on the growth of the cultured explant, the concentrations used were 2% and 4% each of sucrose and glucose respectively while 0% served as control. It was recorded that the explant in 2% and 4% sucrose attained 50% sprouting on the 4th day and produced the highest root length and the highest number of roots. Whereas, 2% and 4% glucose attained 50% sprouting on the 6th day after inoculation and produced the highest leaf length, shoot length, number of leaves and highest value of fresh weight in grams (g). It can, therefore, be said that 4% glucose may be used for leaf proliferation and regeneration of embryonic explants of *Moringa oleifera* and 4% sucrose for root development

Key words: *Moringa oleifera*, embryo culture, sucrose, glucose

BIOACTIVITY OF (*IPOMOEA BATATAS*) SWEET POTATO ETHANOLIC LEAF EXTRACT

¹Oludare Temitope Osuntokun, ^{2*}Yusuf-Babatunde M.A. and ¹Oladele Olasumbo Fasilat

^{1,3}Department of Microbiology, Faculty of Science, Adekunle Ajasin University, Akungba Akoko, Ondo State, Nigeria

²Department of Pharmaceutical Technology, Ogun State College of Health Technology, Ilese-Ijebu, Nigeria

* ogbonronka@gmail.com

ABSTRACT

Sweet potato (SP) popularly known as *Ipomoea batatas*, has played an important role as an energy and a phytochemical source in human nutrition and animal feeding as well as herbal medicine to treat inflammatory and/or infectious oral diseases in Nigeria. This research aims to evaluate the secondary metabolites (phytochemical), antioxidants, and antimicrobial activities as well as proximate analysis and to determine the minerals content of sweet potato ethanolic leaf extracts. Qualitative phytochemical screening of the leaf extract was carried out on triterpenes, steroids, alkaloids, anthraquinones, coumarins, flavonoids, saponins, tannins, and phenolic acids. Antimicrobial activity was evaluated using agar well diffusion technique to determine the susceptibility of SP against *Salmonella* sp., *Listeria monocytogens*, *Staphylococcus aureus*, *Vibrio* sp, *Pseudomonas aeruginosa* and *Enterococcus* sp. Antioxidant activity was determined by hydroxyl radical scavenging, nitric oxide radical inhibition and ferric reducing properties of SP. The phytochemical screening showed the presence of alkaloids, saponin, cardiac glycosides, tannin, terpenoid, steroid and flavonoids respectively with the following values, 13.649 mg/g, 2.545mg/g, 8.271mg/g, 4.726mg/g, 6.888mg/g, 0.276mg/g and 0.852 mg/g. Proximate analysis of SP leaf gave moisture content (MC), crude fat (CF), crude protein (CP), ash content (ASH), cured fat (CFAT) and carbohydrate (CHO) as 32.98, 0.725, 14.953, 5.863, 0.319 and 45.16% respectively. The zones of inhibition of bacterial growth at different concentrations (100mg/ml, 50mg/ml, 25mg/ml and 12.5 mg/ml) of SP leaf extracts showed the highest antibacterial activity to *Salmonella* sp with 25 mm zones of inhibition, and activity to *Listeria monocytogens*, *Staphylococcus aureus*, *Vibrio* sp. and *Pseudomonas aeruginosa* all with 20 mm zones of inhibition. However, the leaf extracts had the lowest antimicrobial activity to *Enterococcus*

ssp. with 7 mm diameter. SP leaves demonstrated the presence of secondary metabolites with potential biological activities. Therefore, it can be concluded that the bioactive components and antimicrobial activity of sweet potato against bacteria shows its medicinal value and supports the widespread use of the plant as local remedy for a variety of ailments.

Keywords: Bioactivity, *Ipomoea batatas*, Sweet potato, Leaf extract

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INVESTIGATION OF THE ROLE OF MICRONUTRIENTS IN EUTROPHICATION: QUANTITATION OF SILICON IN LAGOS COASTAL WATER

Oyebisi R.O., *Abayomi A.A., Olayinka K.O. and Alo B. I.

Department of Chemistry University of Lagos

* aabayomi@unilag.edu.ng

ABSTRACT

Silicon has been identified as one of the important drivers of eutrophication in surface waters but, has been less studied in Nigeria water bodies, especially, in the eutrophic waters of Lagos. This study aims to determine the levels and variation of silicon in Lagos coastal water along the Epe – Badagry belt. Eighty (80) water samples (from both top and bottom of the water) were collected between January and March, 2020 at 29 different locations along the Lagos coastal water systems from Epe to Badagry with particular attention paid to watersheds discharging water into the systems. Physico-chemical parameters of the water were measured in-situ using Horiba U-52 multi parameter meter and the silicon levels in the water samples determined by colorimetric analysis. TDS; Turbidity and pH were in the ranges of 0.03-188 g L⁻¹; 1.90 - 188 NTU and 6.14 - 9.12 while level of silicon in the coastal water system ranged from 0.42–13.11 mg L⁻¹ and 0.33 - 15.0 mg L⁻¹ for top and bottom water respectively. The coastal water system was observed to be highly eutrophic. River Odo-Iyalaro area was observed to have the highest level of silicon with high turbidity in the entire stretch investigated. This could be attributed to higher anthropogenic activities around that area of the coastal waters. This paper provides a review for the quantitation of silicon in Lagos coastal waters and provides preliminary elucidation of the seasonal eutrophication of Lagos coastal waters observed.

Keywords: Silicon; Micro-nutrients; Quality Assurance; Eutrophication.

**EFFECTS OF PHYSICOCHEMICAL CONDITIONS AND ANTHROPOGENIC
ACTIVITIES ON NUTRIENT ENRICHMENT: ASSESSMENT OF PHOSPHORUS
LEVEL AND SPECIES IN COASTAL WATERS OF LAGOS STATE**

Echebiri F.O., *Abayomi A.A., Olayinka K.O. and Alo B.I.

Department of Chemistry, University of Lagos, Lagos, Nigeria

* aabayomi@unilag.edu.ng

ABSTRACT

The level of phosphate and its species in coastal waters of Lagos State were studied and related with various point and diffuse sources of nutrient enrichment into coastal waters between November 2019 and March 2020. Water samples were collected from surface and bottom levels in thirteen selected locations along the Epe coastal waters during these months. Physicochemical parameters of the water samples were collected immediately at site using *in situ* monitor. Phosphate level in the samples was determined using colorimetric method (ammonium molybdate with ascorbic acid as reductant). The range of total phosphate was between 86.29 $\mu\text{g L}^{-1}$ and 2410.9 $\mu\text{g L}^{-1}$, level of inorganic phosphate was between 12.57 $\mu\text{g L}^{-1}$ and 1458.22 $\mu\text{g L}^{-1}$ while organic phosphate ranged between 23.4 and 1295.45 $\mu\text{g L}^{-1}$. The high level of phosphate species in the coastal waters is a major source of eutrophication evidenced by water hyacinth bloom during this period. Salinity was also found to affect the phosphate distribution in water samples. The results of this study showed that anthropogenic activities peculiar to the immediate coastal environments as well as physicochemical reactions of the water body impact to a large extent on the nutrient load of the coastal waters.

Keywords: Eutrophication, nutrient enrichment, salinity

SYNTHESIS AND PHOTOCHEMICAL PROPERTIES OF 1-(2'-AMINO-3',5'-DIBROMOPHENYL)-3-ARYL-2-PROP-2-EN-1-ONES

***Oyeyiola, F.A. and Soile O.B.**

Department of Chemistry and Biochemistry, College of Pure and Applied Sciences, Caleb University, Imota, Lagos, Nigeria

*felix.oyeyiola@calebuniversity.edu.ng

ABSTRACT

The versatile 2-aminoacetophenone was functionalized when reacted with *N*-bromosuccinimide (NBS) in acetic acid at room temperature to afford the 3,5-dibromo-2-aminoacetophenone in good yield. The latter was, in turn, subjected to Claisen-Schmidt aldol condensation with benzaldehyde derivatives¹ in the presence of sodium hydroxide in ethanol at room temperature to yield the corresponding substituted dibrominated 2-aminochalcones [1-(2'-amino-3',5'-dibromophenyl)-3-aryl-2-prop-2-en-1-ones] in good yields. The absorption and emission spectra of the new compounds were measured to evaluate their potential photophysical properties. All the compounds were characterized by a combination of spectroscopic and mass spectrometric techniques.

Keywords: 2-Aminoacetophenone, *N*-bromosuccinamide, 3,5-dibromo-2-aminoacetophenone, Claisen-Schmidt, benzaldehydes