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TOPIC:

**ONE CAUSE, MANY CRISES
THE KINETIC INTERPRETATION
OF WELLNESS**

By
PROFESSOR (MRS.) GRACE OLAPEJU OTINWA

One Cause, Many Crises: The Kinetic Interpretation of Wellness

An Inaugural Lecture Delivered at the University of Lagos
Main Auditorium on Wednesday, 19th March, 2014

By

PROFESSOR GRACE OLAPEJU OTINWA

B. Ed. (Zaria), M. Ed., Ph.D (Ibadan)

Professor of Exercise Physiology

Department of Human kinetics and Health Education
Faculty of Education
University of Lagos

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DEDICATION

This lecture is dedicated to our Lord Jesus Christ who led an unequalled physically active life and enjoined us to walk in His steps.

One Cause, Many Crises: The Kinetic Interpretation of Wellness

Preamble

The Vice-Chancellor;
Deputy Vice-Chancellors: Academic & Research and
Management Services;
Registrar;
Bursar;
Librarian;
Principal Officers of other Universities
Provost - College of Medicine;
Dean of Faculty of Education;
All other Deans;
Head of Departments;
Directors;
My Lords Spiritual and Temporal;
Teaching and Non-Teaching Staff;
Students;
Gentlemen of the Print and Electronic Media;
Family Members;
All Invited Guests;
Distinguished Ladies and Gentlemen.

It is my pleasure to welcome you to the 256th Inaugural Lecture in the University of Lagos, which is the 24th in the Faculty of Education; the 3rd in the Department of Human kinetics and Health Education and the 1st in both Exercise physiology and the year 2014. My lecturing career started at Lagos State College of Education (LACOED) now Adeniran Ogunsanya College of Education (AOCED) from where I joined the services of University of Lagos, Lagos. In lecturing I found the opportunity to express my passion for Exercise Physiology with the students taught both at AOCED and at the University of Lagos. I am grateful to God for the opportunity to engage my talents in lecturing and community service. It was during my lecturing sojourn that I developed sympathy for individuals suffering from unhealthy lifestyle problems, having observed that people were dying mostly from preventable diseases. This informed my research focus and the choice of this inaugural lecture, titled: "One Cause, Many Crises: The Kinetic Interpretation of Wellness". The main body of this inaugural lecture is structured into six parts: These are:

- i. Epidemiological transition to physical inactivity
- ii. Fat pattern and epidemic of obesity
- iii. Consequences of physical inactivity
- iv. The role of exercise in the prevention and treatment of diseases and
- v. Principles of exercise prescription and compliance,
- vi. Economic and Psychosocial cost of physical inactivity.

Introduction

One Cause – Epidemiological Transition to Physical Inactivity

The structure of the human body as designed by God and defined by Exercise Physiologists comprises: (i) fat-free weight - which is made up of bones, muscles, skin, blood

and organs and (ii) the fat weight, which consists of stored and essential fats. These components of the human anatomy function well when food ingested converts potential chemical energy derived from it into chemical and heat energy. If the amount of energy intake equals the amount of energy expended, the body is in a state of energy balance and weight remains stable. This biological nature of human beings has made it necessary for people to engage in one form of physical activity or another, from birth to death. However, if excess food is ingested, the extra energy derived is not lost; this leads to weight gain, which often leads to energy imbalance and results in systemic malfunction (Plowman & Smith, 2003).

Energy, like matter, cannot be destroyed but can be transformed from one form to another. Physiologically, physical activity is a major means by which the body maintains equilibrium between energy intake and energy output. Physical activity (PA) is the bodily movement produced by skeletal muscles that result in energy utilisation. This includes a broad range of occupational, athletic, leisure-time, and routine daily-activities such as housework, farming and brisk walking. These activities require light, moderate, or vigorous efforts and can lead to improved health if practised regularly (Otinwa, 2010). Physical activity is also described as the movement carried out with the aim of sustaining daily living and not necessarily for physical fitness attainment; it also requires the expenditure of energy. However, exercise, is not synonymous with physical activity. Exercise is a sub category of physical activity.

Exercise is a form of physical activity that is planned or structured. It involves repetitive bodily movements done to improve or maintain one or more of the components of physical fitness: aerobic capacity, muscular strength,

muscular endurance, flexibility, body composition, agility, balance, power, re-action time, co-ordination and speed. All conditioning and sporting activities are considered exercise because they are generally performed to improve or maintain physical fitness. Physiologically, exercise is described as a single bout of bodily exertion or muscular activity that requires an expenditure of energy above resting level and generally results in voluntary movements (Plowman & Smith, 2003; Otinwa, 2010). The activity must be of sufficient intensity, duration and frequency to be able to achieve wellness. For example, walking to the office or market is a form of physical activity while walking regularly at a constant speed and for a specific duration is exercise. From a physiological perspective, both activities bring about changes. I hope that these definitions have cleared the misconceptions surrounding physical activity and exercise. It is against this background that the field of Exercise Physiology, a basic and an applied science describes, explains and uses the body's response to exercise and adaptation to exercise training to maximise human physical potentials. For the purpose of this lecture, physical activity will be used interchangeably with exercise.

Primordial Forms of Physical Activity

Views about the place and status of physical activities have been changing from primitive times to the advent of civilisation and technology (Otinwa, 2012). These changes have been classified into three stages.

The Pre-Agrarian Era

At creation, God's original intention for humankind was that it should enjoy and have total control over all that He created, especially the rich agricultural Garden of Eden. The fall of man however, marked the beginning of an

altered lifestyle, which required humans to live in caves. At this point, humans were predominantly hunters, food gatherers and nomads. The prevailing environment was a hostile one; thus, humans had to be extremely active in order to survive their constant battles with nature. They naturally developed physical activity skills in hunting, spear throwing and stalking of animals. People ran because they were forced to run: they were either running after wild animals or were themselves running away from wild animals. Certainly, to cross rivers, the only choice they had was to swim. Other survival skills included walking long distances, running, jumping, swimming and wrestling. These activities were not in any way organised. The physical activity pattern of humans became a means of producing able-bodied 'soldiers' while only the toughest and fittest individuals could survive the hostile environment of this era.

The Agrarian Era

Thousands of years later, prehistoric societies developed and human beings started to live in settlements. Along the line, they discovered farming and irrigation, as well as specialising in the production of agricultural goods and their exchange. They learned to domesticate animals; this led to a reduction in nomadic activity and resulted in a stationary way of life based on grazing of animals and planting of crops. People were no more forced to move as there was no longer need to pursue animals, and food production had expanded. In these societies, games were vestiges of warfare and practiced as sport. This was how certain sports emerged. For example, when hunting and running were no longer useful in their original forms that is, functional use during the Pre-Agrarian era, they evolved as Archery and Running events. Humankind had finally taken control of the environment, and developed a social structure and organisation. This marked the

evolution of a complex civilisation. This era witnessed a reduction in somatic energy expenditure but was marked by increase in food intake and more time for leisure and relaxation. Leisure activities grew from earlier survival skills and became a form of recreation (Recreation and leisure in modern society, 2014).

In Africa, traditional sports like wrestling contests, games, tribal dances, moonlight plays, as well as arts, are used for various purposes such as ceremonies, socialisation and special festivals. In Nigeria, adults had their own forms of physical activities that came mainly from their everyday life pursuits, such as farming, fishing, hunting, pottery, cattle rearing, swimming, canoeing, carving and cloth weaving. These activities naturally forced the indigenous peoples of Africa to develop strength and physical fitness. The adults in turn taught their children some of these physical and occupational skills through role-playing and imitation, especially those skills needed for adult living and for survival. It was the belief that the occupational skills taught to the children were good enough for their physical growth, which in turn would help them in games and play activities (Engstrom, 2004; Otinwa, 2012).

The Post-Agrarian Era

Civilisation has forced rapid social changes on humankind in all spheres of life. One of the major social changes was the gradual transition from pre-agrarian daily living that contained high levels of somatic energy expenditure to an increasingly sedentary lifestyle in the modern era. Despite a looming energy crisis, a marked decrease in physical activity has occurred through industrialisation, computerisation, communication, transportation and urbanisation. This does not exclude improved technology such as automobiles, elevators, electric household appliances and power tools that are

being used extensively by practically everyone (Otinwa, 2012).

Over forty years ago, it was observed that:

In technologically advanced countries a large number of people who once worked with their hands are shifting over to work that they do with their minds, almost without direct contact with materials and tools.... In 1900, 18 out of 20 Americans earned their living by working with their hands, 10 of those 18 as farmers. By 1956, more than half of the work force had put on white collars. By 1956, only 5 out of 20 are in a vastly larger work force - did manual work, and only one worked on the farm (Drucker, 1973).

Today in many homes, factories and offices, machines now supply the power for most work. Machines have virtually eliminated the necessity for extensive walking, running, lifting or climbing in some countries. For example, television holds people in captive idleness for an average of 22 hours a week. Other forms of electrical devices are able to perform work so extensively and rapidly that the use of the musculoskeletal systems of the human body has been greatly diminished. Therefore, for many people, the task of daily living does not provide enough vigorous exercise for them to develop and maintain a satisfactory level of cardiovascular fitness, good muscle tone or the recommended body weight. Inactivity combined with poor personal health practices such as poor diet on the part of many could pose massive physical fitness problems.

Prevalence of Physical Inactivity

Today, hypokinetic diseases have become very common globally. Physical inactivity (PI) is a public health concern

for all people, but people with disability are at much greater risk of the serious health problems associated with PI. The health issue of PI is universal and does not exclude developing countries. Indeed, increasing levels of physical inactivity are being seen worldwide, in high-income countries as well as low and middle-income ones (World Health Organisation, 2010). Globally, around 31% of adults aged 15 and over were insufficiently active in 2008 (men 28% and women 34%). Approximately 3.2 million deaths each year are attributable to insufficient physical activity. This status was found to be highest in the World Health Organisation (WHO) Region of the Americas and the Eastern Mediterranean Region. In all WHO Regions, men were found to be more active than women, with the biggest difference in prevalence between the two sexes in the Eastern Mediterranean. This difference is also the case in nearly every country. Physical inactivity is the fourth leading risk factor for global mortality (6% of deaths globally) is estimated as the main cause for approximately 21–25% of breast and colon cancers, 27% of diabetes and approximately 30% of ischemic heart disease burden (Otinwa 2010, 2012).

In Africa, the findings of pooled meta-analysis research showed that 13% of West African populations were inactive. The pooled physical inactivity in African women was higher than in men, this being contrary to the claim that African women are more active than African men. The estimated combined inactivity was 18% in urban populations and 9.0% in rural populations (Abubakari et al., 2009). Otinwa (2008) affirmed that in Africa and other developing countries, there is an acute transition from their traditional ways to a westernised or modern-world lifestyle. This transition is seen, for example, in the fast food and high caloric diet and lifestyle of urban dwellers in emerging megacities like Lagos and Port Harcourt.

Even though there are few researches regarding the physical activity patterns of Nigerians, history shows that physical inactivity is presently common in many of the country's urban settings. The prevalence of physical inactivity increased with urbanisation and with the increasing socio-economic status of citizens.

There is strong evidence to show that physical inactivity worsens the health condition of people with major non-communicable diseases and shortens life expectancy (Lee, et al. 2012). Although the benefits of exercise and the harm of physical inactivity might seem like two sides of a coin, the benefits message emphasised so far has not worked well for most people. For example, in the case of tobacco control, doctors would not usually emphasise the benefits of non-smoking, but its harm. However, data from credible global and national agencies indicate that emphasis should be on the harm of inactivity and not merely the benefits of physical activity. (Wen & Wu, 2012; Otinwa, 2013).

Fat Patterning and Obesity

Energy Equation and Body Weight

Energy balance has been a central selective force throughout human evolutionary history. Obtaining dietary energy and nutrients from the environment traditionally required an expenditure of somatic energy through human movement. Energy balance is the integrated effects of diet, physical activity, and genetics on growth and body weight over an individual's lifetime (Katzmarzy, 2010; National Cancer Institute, 2014).

Energy intake (E_{in}) from food nutrients is provided by proteins, carbohydrates and fats; the highest caloric supply comes from fat. **Energy output** (E_{out}) represents

the total energy expenditure, which comprises basal metabolic rate (BMR), physical activity and the thermic effect of food. (Titchenal, 1988).

There are three dimensions of energy balance:

Equilibrium energy balance occurs when caloric intake of food approximates the calories expended; weight is therefore maintained:

$$E_{in} = E_{out} \longrightarrow \text{Weight balance}$$

Positive energy balance is when caloric intake is greater than the calories expended:

$$E_{in} < E_{out} \longrightarrow \text{Weight gain}$$

Negative energy balance is experienced when caloric intake is less than the calories expended:

$$E_{in} > E_{out} \longrightarrow \text{Decrease in weight}$$

Unbalanced Equation

A positive energy balance results in either overweight or obesity. These conditions indicate body weight that is greater than what is healthy. Both conditions are determined by body mass index (BMI), which expresses the relationship between an individual's weight in kilogrammes and height. That is, weight/height^2 . An individual is considered overweight when BMI value is between 25 to 29.9 kg/m^2 , while an obese person is one with a BMI value of 30 kg/m^2 and above. The difference between the two conditions is the level of risks associated with diseases. However, an individual might be overweight and be healthy because of muscular hypertrophy. This condition is common among athletes. Obesity is a condition in which a person has an abnormally high and unhealthy proportion of body fat; this is harmful to the body.

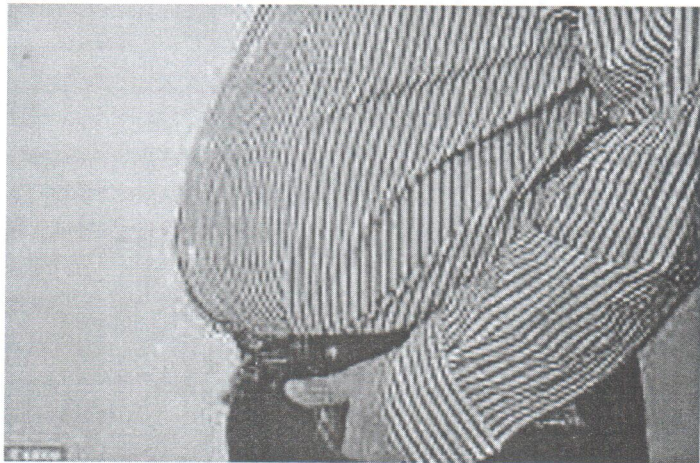
Fat Patterning

Fat storage varies among individuals. In general, fat distribution is in three basic patterns: android, gynoid and intermediate patterns. All these patterns can be found in males and females, although there is a self-specific dominant associated with android and gynoid patterns.

Android Pattern

The android pattern, also known as the abdominal or apple pattern, is characterised by the storage of fat in the nape of the neck, the shoulder and the abdomen (upper part of the body.). In this pattern, the largest quantity of fat is stored internally, not subcutaneously. The result is the classic pot-belly shape.

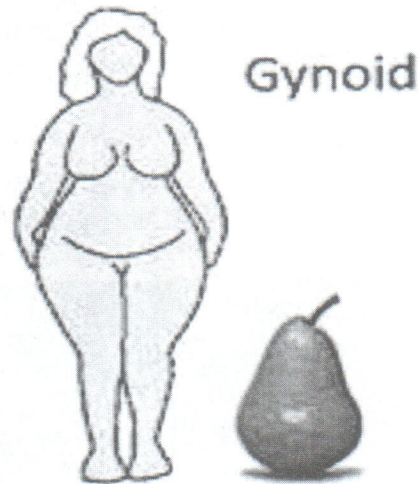
Fig. 1: Android Pattern



Gynoid Pattern

The gynoid pattern, also called the gluteal-femoral or pear pattern, is found predominantly among females. It is characterised by the storage of fat in the lower part of the body, specifically in the thighs and buttocks, with the largest quantity being stored subcutaneously. No pseudo hardness is apparent. These sites of fat storage tend to be soft, and jiggle.

Fig. 2: Gynoid



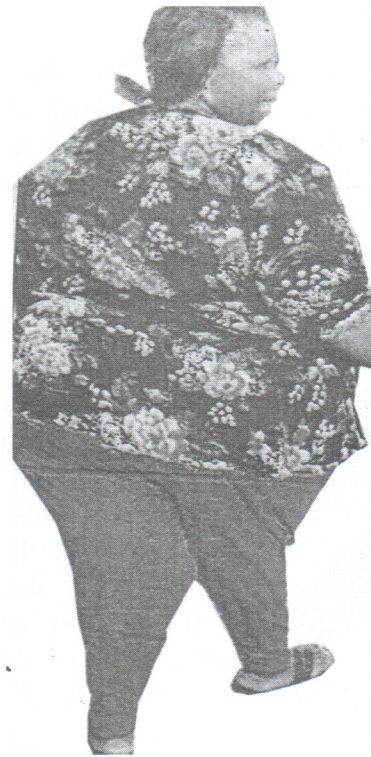
Intermediate Pattern

In the intermediate pattern, fat is stored in both the upper and the lower parts of the body, giving a somewhat rectangular cubic appearance.

Abdominal fat deposits are easily mobilised; therefore it is relatively easy to reduce fat accumulation in this area. Conversely, gluteal-femoral fat deposits are not easily mobilised, and so it is less easy to reduce fat accumulation in these areas. The potential for reshaping

the gluteal-femoral fat pattern is extremely limited (Otinwa, 2010).

Fig. 3: Intermediate



Global Status of Overweight and Obesity

From the perspective of an Exercise Physiologist, the immediate effects of inadequate physical activity are overweight and obesity. These conditions are increasing at an alarming rate throughout the world. The increasing prevalence of overweight and obesity across the globe has aptly been described as the obesity epidemic. Today it is estimated that there are more than 300 million obese people worldwide. Physical inactivity has resulted in at least 2.8 million people dying each year because of being overweight or obese. The prevalence of obesity is

worldwide, affecting men, women and children. Many countries have experienced a startling increase in obesity rates over the last 10-20 years. Over the past decade obesity levels have increased on an average of 10-40% (Otinwa, 2009).

Global projections released by the World Health Organisation indicate that 1.6 billion adults (age 15+) were overweight in 2005 and at least 400 million adults were obese. By 2015, approximately 2.3 billion adults will be overweight and more than 700 million will be obese. At least 20 million children under the age of 5 years were overweight globally in 2005 (WHO, 2006). In 2010, more than 40 million children under five were overweight. Even though it was once considered a high-income country problem, overweight and obesity are now on the rise in low- and middle-income countries, particularly in urban settings. Close to 35 million overweight children are living in developing countries and 8 million in developed countries. Overweight and obesity are linked to more deaths worldwide than underweight. For example, 65% of the world's population live in countries where overweight and obesity kill more people than underweight (this includes all high-income and most middle-income countries).

The United States of America Department of Health and Human services (CDC, 2007) presented data of the national health and nutrition examination survey which showed that the national percentage of overweight or obese adults aged 20 years and above rose from 56% in the 1988-94 survey to 64% in the 1999-2000 survey. In 1999-2000, 27.5% of men were obese, and by 2009-2010 the prevalence had increased to 35.5%. Among women, 33.4% were obese in 1999-2000 with no significant change in 2009-2010 (35.8%). In 1999-2000,

the prevalence of obesity was higher in women than in men. At present, obesity and overweight have reached epidemic proportions in the United States. United States President Barack Obama noted that "as a nation, our greatest responsibility is to insure the well-being of our children." He further suggested that "by taking action to address the issue of childhood obesity, we can help America's next generation reach their full potential." (Ogden, Carroll, Kit, & Flegal, 2012).

Tremblay and Williams (2000) reported dramatic increases in the prevalence of obesity among Canadian children. Torrance, Hooper and Reader (2002) specifically found the prevalence of obesity in Canada to increase substantially between 1979 and 1992 and across all educational levels. The prevalence and increasing incidence also seems to cut across socio-economic status, level of education, age and the level of development of the population (Caterson & Gill, 2002; Fontana et al., 2007; Fouad et al., 2006). In England the prevalence of obesity has doubled since 1980. Based on current trends, it is predicted that the levels of obesity will continue to rise unless action is taken now. In a study of a Syrian population, Fouad et al. (2006) found that 36.9 % of the males and 27.7% of the females were overweight and 28.8% of the males and 46.4% of the females were obese. They further reported the prevalence of obesity among women to be 38.2% higher than that of men.

Furthermore, obesity is no longer just a concern for developed countries; it is becoming an increasing problem in African countries. By far, the largest regional percentage increase in population by 2050 will be in Africa, whose population can be expected to at least double from 1.1 billion to about 2.3 billion. The implications for obesity health problems will increase if

appropriate measures are not taken (Otinwa & Owolabi, 2008). In a meta-analysis of 16 lifestyle studies in Africa, 13 were on Nigerians and three on Ghanaians. The prevalence of physical inactivity ranged between 25% and 57%. One study reported much higher prevalence of physical inactivity in women compared with men. Diabetes seemed rare at 0.2% in urban Ghana in 1963 and 1.65% in urban Nigeria in 1985. For each study in the two countries, obesity was approximately four times higher in women than men (Otinwa, 2010).

A further study on obesity levels among black women in South Africa, as reported by Krugger et al. (2002) found that BMI was positively associated with household income in their study sample. In developing countries, income is positively associated with intake of fat and animal-protein foods. Total energy and fat intakes in this study were associated with income level, which may indicate that factors other than dietary intake but associated with income level – such as physical activity level – may be more important determinants of BMI. Mean household income was also positively associated with other indices of obesity. The high prevalence of obesity in groups of low socioeconomic status has been attributed to a more tolerant social climate toward obesity. This perception could motivate people to adopt lifestyles that make them fat to attain 'societal recognition'.

In younger populations, the physical activity levels of children and adolescents are attracting more research attention largely because of the changing lifestyles that have threatened the opportunity to be active and introduced attractive sedentary alternatives. Research has shown that children and adolescents have become less active to a point where it is seriously damaging their current and future health (Fox & Riddoch, 1999; Otinwa,

2009). Increasingly, children are at risk of well-known consequences of excess weight, e.g., heart disease and diabetes (Beaulieu, Butterfield & Pratt, 2009).

Culturally, in Nigeria, overweight and obesity are socially accepted as evidence of good living and a sign of affluence and riches. This physical condition is considered aesthetically pleasing. In certain cultures, such as found in Cross River and Akwa Ibom states, it is customary for young women being prepared for marriage to go into the fattening room to eat a lot of starch. After marriage, it is expected that women will assume a round figure by gaining weight because of their new marital status. Similarly, the men are expected to become pot-bellied. Socially, the bigger the body frame, the more the respect earned by these people. We even give such people appellations such as "orobo", etc. indicating a more tolerant social climate toward obesity. However, these traditional views about fatness as evidence of good living are posited to be detrimental to health, as excessive body fat is a major precursor to many serious cardiovascular and related health problems. Surveys conducted among urban women in Nigeria shows prevalence of overweight and obesity (Adeogun, 2011; Otinwa, 2002, 2005, 2006, 2008, 2009). All the above health conditions have no doubt affected the life expectancy of Nigerians. The World Health Organisation recently stated that "the growth in the number of severely overweight adults is expected to double that of underweight by 2025" (WHO, 2006).

Health Consequences of Physical Inactivity: Non-Communicable Diseases

The world is faced with the prospect of millions of people dying prematurely and suffering needlessly from hypokinetic behaviour-related diseases such as chronic non-communicable diseases (NCDs). These diseases are

the leading causes of mortality worldwide, representing 60% of all deaths. In 2011, the United Nations focused the world's attention on the growing impact of both communicable and non-communicable diseases in low- and middle-income countries. In regions where infectious diseases are still common, cardiovascular disease, diabetes, chronic respiratory diseases, and cancer are rising at an alarming rate. These diseases are gradually putting pressure on health care systems; and with increasing urbanisation as is currently being experienced in Nigerian cities such as Lagos, Port Harcourt and the Federal Capital Territory, Abuja, this situation will only accelerate the strain. In a major policy initiative of the United Nations, Secretary-General Ban Ki-Moon (2011) has drawn attention to the fact that three out of five people on earth die from non-communicable diseases.

Out of 35 million people who died from chronic disease in 2005, half were under 70 years and half were women (WHO, 2012). Currently, these chronic diseases are steadily growing and approximately 17 million people die prematurely. This invisible epidemic is an under-appreciated cause of poverty and hinders the economic development of many countries. Statistics show that NCDs are on the increase in Nigeria. About 15 million Nigerians have stroke yearly; 100,000 new cases of cancer are diagnosed yearly; 8 million Nigerians have hypertension; over 4.8 million Nigerians have diabetes; 15,000 Nigerians are down with chronic kidney failure every year; and over one million Nigerians are blind (Fabunmi, 2013).

In earlier studies, (Sanya, Akande, Opadijo & Olarinoye, 2008; Ike, 2008) reported that NCDs constitute 69% of hospital admission in University of Ilorin Teaching Hospital and 60.3% at University of Nigeria Teaching Hospital respectively. The rate of NCD patient admission

at the University of Lagos Medical Centre Akoka, in the last 5 years shows that (University of Lagos Medical Centre, 2014).

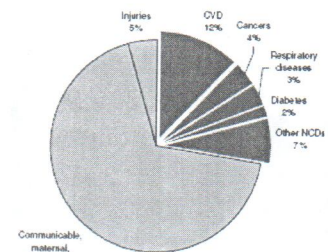
Table 1: Statistics on Non-Communicable Diseases in Nigeria

NCD mortality*			
2008 estimates		males	females
Total NCD deaths (1000s)		254.6	285.2
NCD deaths under age 60 (percent of all NCD deaths)		41.5	41.8
Age-standardized death rate per 100 000			
All NCDs		818.2	792.6
Cancers		99.4	98.8
Chronic respiratory diseases		119.0	71.6
Cardiovascular diseases and diabetes		435.9	475.7

Behavioural risk factors			
2008 estimated prevalence (%)		males	females
Current daily tobacco smoking		7.6	1.7
Physical inactivity	

Metabolic risk factors			
2008 estimated prevalence (%)		males	females
Raised blood pressure		41.5	44.0
Raised blood glucose		6.9	10.0
Overweight		24.2	29.3
Obesity		4.6	6.4
Raised cholesterol		13.6	18.5

Proportional mortality (% of total deaths, all ages)*

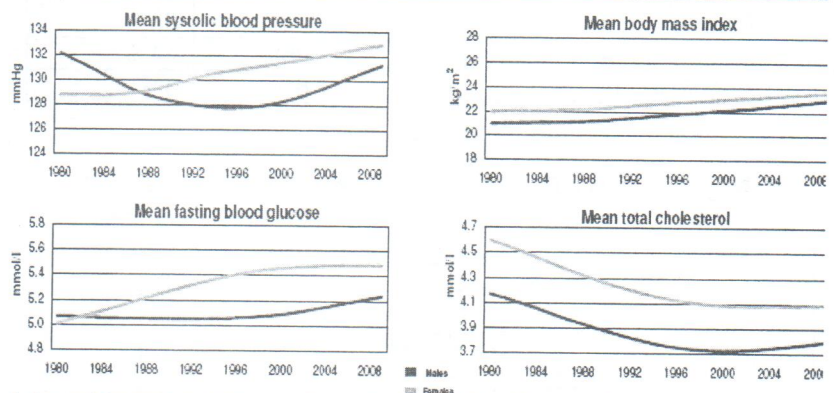


NCDs are estimated to account for 27% of all deaths.

Adapted from World Health Organisation - NCD Country Profiles, 2011

Fig. 4: Metabolic Risk Factor Trends

Metabolic risk factor trends

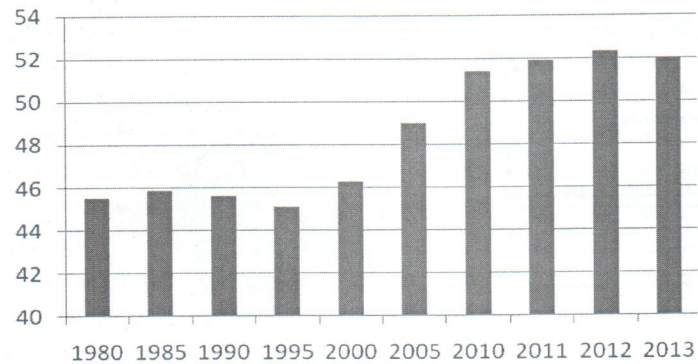


Adapted from World Health Organisation, NCD Country Profiles, 2011.

The above statistics show the contributory effect of NCDs on the projected life expectancy at birth of Nigerians, which is found to be lower when compared with that of the world and particularly the less developed world

(Population Reference Bureau, 2013). Figures 3 and 4 present the graphical illustration of Nigeria's life expectancy and population pyramid by gender.

Fig. 5: Life Expectancy at Birth



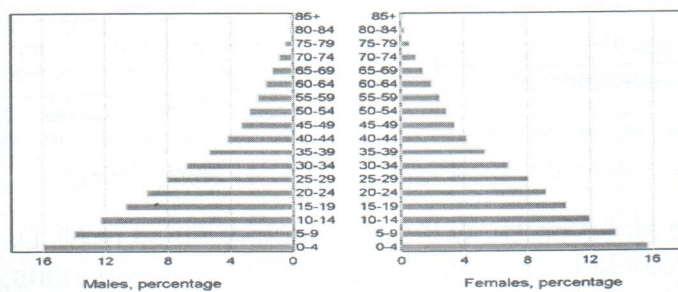
Source: Adapted from Population Reference Bureau, 2013.

Table 2: Life Expectancy at Birth by Gender and the World

S/n	Variable	World (yrs)	Nigeria (yrs)
	Life Expectancy at Birth		
1.	Both sexes	70	52
	Females	68	51
	Males	72	53
2.	Population under (15yrs)	26%	44%
3.	Population 65 (yrs)	8%	3%

Source: Population Reference Bureau, 2013

Fig. 6: Nigerian 2012 Population Pyramid



Source: United Nations, Population Division. The World Population Prospects - the 2008 revision. New York, 2009.

Metabolic Syndrome

Central adiposity is a key feature of the metabolic syndrome (MS), reflecting the fact that the syndrome's prevalence is driven by the strong relationship between waist circumferences and increasing adiposity. MS is a cluster of health-threatening and lifestyle related conditions. The criterion used to define MS are increased waist circumference, increased triglycerides, decreased high density lipoproteins-cholesterol (HDL-C), increased blood pressure and increased plasma glucose. Anyone who has three or more of these criteria is diagnosed as having MS (WHO 2013).

Metabolic syndrome affects 44% of world population older than age 50. With respect to that demographic, the percentage of women having the syndrome is higher than that of men. The age dependency of the syndrome's prevalence is seen in most populations around the world. Excess body adiposity is a major component of the metabolic syndrome, a consortium of diseases which have been discovered to later lead to diabetes type 2, heart diseases and cerebro-vascular accident, if not properly controlled and treated (Bakker, Gnasevoort & Zeeuw, 2007; Kasliwal et al., 2006).

Cardiovascular Disease

Physical inactivity is a predictor of cardiovascular disease (CVD) and related mortality. The role of physical inactivity in the causation of CVDs is related to the increased obesity, which creates a disposition to a raised blood pressure and elevated serum cholesterol as well as a greater risk of diabetes mellitus. The most important cardiovascular diseases (CVDs) are those related to atherosclerosis, hypertension and cerebro-vascular disorders (Plowman & Smith, 2003). Globally, CVD accounts for 13% of the disease burden in adults and

approximately half of the deaths caused by non-communicable diseases, that is, 16.7 million. In developed countries, CVD is the main cause of premature death in 38% of men and 44% of women. Furthermore, the mortality and disease burden resulting from CVD are also increasing dramatically in developing nations in general and this is due to the global epidemic of obesity and the metabolic syndrome (MS). In 1999, cardiovascular disease contributed to a third of global deaths. In low and middle-income countries, CVD contributed up to 78% of cardiovascular deaths. The burden of CVD is increasing rapidly in Africa and it is now a public health problem throughout the region. Worldwide, CVDs prevalence could be attributed to behavioural and physiological risk factors such as inactive lifestyle and inadequate diet. According to the World Health Organisation (2006), cardiovascular diseases, overweight and obesity related diseases remain the leading cause of death in some developed countries with higher death rates in females than in males.

Diabetes

This condition occurs when the level of glucose or sugar produced from starchy and sugary foods such as rice, cassava, yam, corn meals is too high in the blood because the body is not processing it properly. Ordinarily, it is the function of insulin, a hormone produced by the pancreas, to ensure that sugar enters the cells to provide the energy needed for the day-to-day activities. This hormone also ensures that blood glucose levels remain within acceptable limits. However, when this vital function is not effectively discharged, diabetes sets in. According to WHO (2013), the most common types of diabetes are the type 1 and type 2, also called diabetes mellitus. Other forms include gestational diabetes, usually noticed in

pregnant women, which could progress into type 2 if not properly managed. Of the two main types, type 2, which afflicts adults, is the more common and accounts for about 90 percent of all cases. Type 1 affects children.

According to the International Diabetes Federation (IDF, 2014) there are over 300 million people with diabetes worldwide and this number is expected to grow to around 500 million in a generation. Low- and middle-income countries account for 4 out of 5 cases of diabetes. Most deaths and complications related to diabetes in low and middle-income countries are in the economically productive age group (30 to 50 years). There are 50.8 million people with diabetes in India and 92.4 million in China. Africa will have the highest percentage increase in the number of people with diabetes over the next 20 years. Eighty percent (80%) of people with diabetes in Africa are undiagnosed. Egypt has the highest with 7.3 million. There are 3.2 million Nigerians between the ages of 20 and 79 years living with the condition. Out of the 3.2 million Nigerians with diabetes, about 2.5 million are unaware of their condition.

Cancer

Cancer is presently a major concern for some in this country. One defining feature of cancer is the rapid creation of abnormal cells that grow beyond their usual boundaries, and which can then invade adjoining parts of the body and spread to other organs. Cancers are primarily an environmental disease with 90-95% of cases attributed to environmental factors and 5-10% due to genetics. World Health Organisation statistics shows that about 30% of cancer deaths are due to five behavioural and dietary risks: lack of physical activity, overweight and obesity, low fruit and vegetable intake, tobacco use and alcohol use. It is one of the leading causes of death

worldwide, accounting for 7.6 million deaths (around 13% of all deaths) in 2008. The latest world cancer statistics released shows that an estimated 14.1 million new cancer cases and 8.2 million cancer deaths occurred in 2012. It is estimated that 19.3 million new cancer cases will occur every year (International Agency for Research on Cancer, 2013). Lung, stomach, liver, colon and breast cancer are the most common types of cancer that results in death each year. Deaths from cancer worldwide are projected to continue rising, with an estimated 13.1 million deaths in 2030. More than 30% of cancer can be prevented, mainly by not using tobacco, having a healthy diet, being physically active and preventing infections that may cause cancer (WHO, 2013).

Exercise versus Drugs as Therapeutic Modifiers in Major Non-Communicable Diseases

There is now a world movement labelled "exercise is medicine", (ACSM, 2001). This idea grew out of the realisation that exercise has many physiological benefits when compared with drugs. Exercise has been known over the years to be of great value to physical health and the promotion of sound health. Exercise is perceived as a drug that brings benefits to every part of the body and substantially extends lifespan; yet it seems to receive little attention from many people in society. Exercise is medicine that prevents many health problems like obesity and NCDs. The use of exercise as one of the best treatments for health problems has attracted more collaborative research work in medical practice and exercise physiology. Exercise is more cost-effective than drug therapy. In contrast to drug interventions, physical activity is associated with minimal adverse side-effects. Exercise can be indefinitely sustained by the individual, unlike drug treatments which often have a specified end point. Exercise stands apart from more traditional

treatments and therapies in cases such as mental health problems, because it has the potential to simultaneously improve health and well-being.

The Relationship between Exercise, Body Fat and Body Weight

Regular physical activity positively affects lipid metabolism and lipid profiles. Aerobic physical activities utilise the oxygen energy systems that require the mobilisation and metabolism of the body's fat storage. Exercise training helps the body manage cholesterol level more effectively. Cross-sectional comparison of lipid profiles in physically active and sedentary women suggest that physical fitness is inversely related to total cholesterol (Despres & Lamarche, 1994; Durstine & Thompson, 2000; Otinwa, 2010). Exercise reduces total body fat. Aerobic physical activities utilise the oxygen energy systems that require the mobilisation and metabolism of the body's fat storage. Weight-resistance activities help stimulate muscular development, preventing significant losses of lean body tissue that generally occur during calorie-restricting diets. Exercise training helps the body manage cholesterol levels more effectively.

The immediate function of physical activity in an exercise programme is simply to increase the level of energy expenditure. This helps to unbalance the caloric equation so that there is a greater amount of energy output. Exercise increases strength, posture, balance and decreases falls and their resultant fractures. Physical activity also helps people maintain appropriate body weight. It improves appearance and decreases waistline. Physical activity increases the metabolic rate both during activity and afterwards. To some degree, regular physical activity appears to contribute to the normal functioning of

the brain's feeding control mechanisms. A sensitive balance between energy expenditure and good intake of such is apparently not very well maintained in physically inactive people. Individuals who are physically active are better able to match daily energy intake with daily expenditure.

Exercise and Cardiovascular Health

Regular activity is acknowledged as an important strategy for both prevention and rehabilitation of CVD. Active people are at lower risk of cardiovascular diseases, develop less CVD, or develop CVD at a later age, and tend to have less severe forms of CVD when compared with those who are inactive. Exercises of the right type, intensity, duration and frequency will cause cardiac hypertrophy, which is manifested by either a large ventricular cavity that results in increased stroke volume or thicker ventricular wall leading to a more forceful pumping ability of the heart. Other responses to exercise are: increased maximum cardiac output, decreased resting heart rate, increased oxygen utilisation during exhaustive work, as well as more rapid return of heart rate and blood pressure to normal, following physical activity (Otinwa, 1998).

Physical activity can help to decrease the risk of cardiovascular disease mortality in general and coronary heart disease mortality in particular. There is considerable evidence that exercise is one of the means by which high-density lipoprotein can be increased. This increase works against the atherosclerotic process by resting the movement of low-density lipoprotein into the arterial wall, or promoting the efflux of cholesterol from tissues to the liver where it is broken down and excreted (Hartung et al., 1989). When principles of cardiorespiratory fitness are adopted, there will be

positive and tremendous impact on the muscles of the heart, blood vessels and the lungs (Otinwa, 2010).

Exercise and Diabetes Prevention

Epidemiological studies using cross-sectional data consistently report that physically active individuals are less likely to develop type 2 diabetes in comparison to sedentary individuals. When people who do not have diabetes exercise, they first use glycogen from muscles for energy. As exercise continues, glucose is taken from other sources, such as conversion of glycogen in muscles, and uptake of blood glucose. As blood glucose falls, insulin secretion decreases while glucagon secretion increases. Glucagon facilitates the production of glucose in the liver. If exercise continues further, other hormones, such as epinephrine hormone, growth hormone and cortisol, begin to play a positive role (IDF, 2014).

The benefits of regular exercise for people with diabetes include improved glycemic control. The joint position statement of the American Diabetes Association and the American College of Sports Medicine concludes that exercise regimens at an intensity of 50 to 60% maximal oxygen consumption (VO_2 max) (60 to 70% of maximum heart rate) three to four times a week for 30 to 60 minutes are consistently associated with improvements in carbohydrate metabolism and insulin sensitivity (Canadian Association of Cardiac Rehabilitation, 2000). Regular exercise improves insulin sensitivity. This appears to be modulated through an increased number of glucose transporters on the muscle cell surface. There is a clear long-term benefit of improved glycemic control in people with type 2 diabetes who exercise.

Cancer Prevention through Physical Activity

Earlier studies on cancer shows that physical activity is associated with decreased breast cancer risk. Physical activity is one of the few known modifiable factors and increased physical exercise may play a key role in primary prevention against breast cancer (Matthews, Fowke, Dai, Bradlow & Jin 2004; Kruk, 2007; Bernstein et. al., 1987; Russell, Mitchell, Musey and Collins, 1984).

The Role of Nutrition in Disease Prevention

Adequate nutrition plays a major role in preventing NCDs especially as it relates to being overweight, obese and having high blood cholesterol. By eating a nutritious diet that is low in fats, cholesterol and sodium, an individual can lower susceptibility to heart diseases. Research has shown that vitamins C & E, and fruits and vegetables play a productive role against cardiovascular diseases (Hartung, 1986; Otinwa, 1998; Brown, Thomas & Koteki, 2002). A well-documented change that occurs during dietary restriction of calories is a considerable reduction in resting metabolic rate (RMR). This decline can reach up to 40 percent of RMR after a brief time, significantly reducing overall calorie expenditure by the body.

Principles of Exercise Prescription and Compliance **Exercise Prescription**

Exercise prescription is the process of designing a regimen of physical activity in a systemic and individual manner. The successful integration of the science of exercise physiology with behaviour change principles results in long-term compliance to a physical activity regimen. The goal of the exercise physiologist is therefore to prevent and manage injuries and chronic diseases through lifestyle, exercise and behaviour modification. Each exercise prescription has five essential components. Otinwa (2005) enumerated five guidelines in

the administration of exercise as medicine. These are: frequency, intensity, duration, mode and progression.

Physical activity is now widely accepted among health and medical authorities as one of the important factors in healthy living. Furthermore, exercise is considered as one of the best options in the management of health conditions such as overweight, obesity, CVDs, diabetes and cancer (Otinwa, 2012). The use of exercise as medicine, instead of drug administration, requires designing a regimen of physical activity in a systemic and individual manner. With the successful integration of the science of Exercise Physiology and behaviour change principles, the result is a long-term compliance to a physical activity regimen. This process is prescribed by an Exercise Physiologist and called exercise prescription. This forms the core area of Exercise Physiology (American College of Sports Medicine, ACSM, 2000).

Exercise Dosage

To start an exercise programme, especially for adults who are above 40 years, there must be a detailed medical evaluation with appropriate diagnostic tools done by a medical practitioner. A careful medical history and physical examination should focus on the symptoms and signs of disease affecting the eyes and blood vessels, kidneys, and nervous system. If this physical examination is missing, the result might be injury or in some cases death as experienced by some individuals who have abused exercise. Exercise dosage for children, adults and old people are different but the same guiding principles are applicable to various age groups and sex.

All over the world there is a rising awareness of the need to lead an active lifestyle. This calls for the provision of adequate information and guide on the basic concepts of

exercise in order to maximise the benefits of an exercise programme. Just as any drug would have a dosage for its administration, there is a need to adhere to the exercise dose that will bring about wellness. Just as a medical doctor prescribes drugs for a Pharmacist to dispense, in the same manner an Exercise Physiologist prescribes an exercise programme which a Fitness Instructor administers.

Frequency

The term frequency refers to how often exercise should be done. The recommended frequency for exercise is three to five days per week. The frequency of exercise also depends on the individual's fitness level. Exercise must be performed regularly on selected days of the week with a day of rest in-between for muscular recovery. Some individuals think one exercise outing in a week/month would bring about a positive change in the body, but it does not work this way.

Intensity

Intensity is an indication of how vigorous and hard an individual needs to exercise each day. This is computed through the exercise heart rate, which helps to determine how fast or how hard one is exercising.

Duration

This term gives exercise participants an idea of how much time to spend each day for exercise sessions. From a scientific point of view, it has been recommended that each session should last between 30-60 minutes at prescribed exercise heart rate. In order to prevent injury, beginners must keep intensity low and the duration short (ACSM, 2000).

Mode

Mode has to do with the type of exercise and how to perform it. In each session, a combination of aerobics, flexibility and strength exercises are recommended. For example, when walking is selected as the main workout, it could be varied by walking on a flat surface, hill, treadmill, stairs and water.

Progression

Throughout an exercise programme, there must be a progressive increase in the training volume or load in order to stimulate further improvements. The progression needs to be gradual because "doing too much too soon" may cause musculoskeletal injuries and is a major reason why some individuals drop out of exercise programmes.

Challenging Barriers to Physical Activity and Changing Needs

Physical inactivity is fuelled by several factors. From my interaction with people of different age brackets and research conducted among different population groups, the most common challenges cited for not engaging in regular exercise, in order of significance, are as follows (Otinwa, 2012):

- i. Lack of time
- ii. Cultural Factors
- iii. Social and Environmental Factors
- iv. Psychological Factors
- v. History of Previous Injury
- vi. Educational and Economic factors

i. Lack of Time

The most common barrier to participation in physical activity is a perceived lack of time. Physical exercise must be considered as important to the body as eating, sleeping and breathing. Akintunde (1987) reported that

women do not participate in recreational sport due to lack of time and house care work which keeps them much occupied after working hours. Research participants explained that time spent on recreational sports could be better spent in other ways as many women prefer other forms of recreation, such as relaxation with family members and watching movies.

ii. Cultural Factors

The different socialisation processes have made girls in particular to be traditionally restricted to the home and kitchen. Thus, women and girls have been less active in exercise than men and boys in virtually all age brackets.

iii. Social and Environmental Factors

The social and physical environments in which one lives may serve as a barrier to regular exercise. Socially, being inactive is perceived as normal and in fact doctors order patients to remain on bed rest far more often than they encourage exercise. This passive attitude towards inactivity, where exercise is viewed as a personal choice is, anachronistic.

These barriers are community-based, while some are individual in nature. For example, lack of adequate locations for exercise, increased urbanisation which has resulted in some environmental hindrances such as violence, congested housing, high-density traffic, low air quality, pollution, and lack of parks, sidewalks and sports/recreation facilities.

iv. Psychological Factors

A number of psychological factors influence participation in regular physical activity among adults. Low self-image and lack of confidence in the ability to perform exercise discourage further participation because of the

fear of injury. I have occasionally witnessed exercise participants who could not walk or run on a treadmill and almost fell down as a result. There are other individuals who feel shy to join others for an exercise programme.

v. History of injury

Another factor that serves as a barrier to physical activity is previous history of injury. Once a person has been injured, the likelihood of continuing to be active diminishes. Injuries common to exercise but not limited to these ones include: muscle spasm, ligament tear and dislocation.

Other factors linked to irregular participation in physical activity include age, gender, and genetics (e.g. sickle cell anaemia). Physical activity and exercise tend to decrease across age spans.

vi. Educational and Economic Factors

It is also observable that people with higher educational levels and a more secure financial status participate in exercise programmes at higher rates than others. For example, some individuals cannot afford the cost of registration in a gymnasium. The perceived health benefits of regular exercise motivate the literate person.

Economic and Psychosocial Implications of Physical Inactivity

The health crises resulting from lack of exercise and poor attitude towards physical activity has a major socio-economic impact on the individual, family and society in terms of medical cost, absenteeism from work and national productivity.

Economic Cost

The effects and cost of physical inactivity are very heavy on individuals and the nation. In addition to the health implications (ACSM 2001; 2004; Aronne 2002), it has severe economic implications. Physical inactivity burdens society through the hidden and growing cost of medical care and loss of productivity. The World Economic Forum (WEF) has identified NCDs as the second most severe threat to the global economy in terms of likelihood and potential economic loss. NCDs are a major cause of poverty, a barrier to economic development, and a neglected global emergency. Statistics from the International Diabetes Federation (2014) shows that in 2012, diabetes gulped about \$471 billion in health care expenditures across the world.

Birmingham et al. (1999) conducted a study on the cost of Obesity in Canada and found that about \$2.1 billion (2.5%) of total health care cost in 1999 was attributed to physical inactivity; with the direct costs of hypertension as \$656.6 million, type 2 diabetes \$423.2 million and coronary artery disease as \$346.0 million.

In Nigeria, although the cost implications of the effects of physical inactivity are yet to be computed, it is obvious that the cost is rising because of mortality due to physical inactivity. The volume of human resources lost to hypokinetic diseases in Nigeria has not been quantified. However, we have been witnesses to the deaths of family, colleagues and friends through hypokinetic diseases.

Psycho-social Implications

There are also psycho-social implications for the obese child and adolescent. Indeed, overweight and obese children and adolescents have been known to shun

physical activities. They are socially inept, lazy and possess a negative self-image. It has also been linked with breathing problems (CDC-NCHS, 2007).

Contributions by the Inaugural Lecturer

The health burden associated with physical inactivity informed most of the research works conducted and the follow up activities conducted over the last two decades. Exercise was used as a tripartite instrument in my research works. First as a diagnostic tool in determining the cardiovascular health status of apparently healthy individuals. Secondly as a treatment for some individuals undergoing rehabilitation, and thirdly as a means of preventing hypokinetic diseases and the promotion of general well-being. These three dimensions have been classified under four research categories:

- females
- males
- young people
- athletes

Females

Special attention was given to women in my research works because of the higher prevalence of body fat and physical inactivity among them. Women generally, because of their different occupational choices tend to differ in social status and life habits. These also seem to influence their leisure time activities and consequently, the manifestation and frequency of diseases. Furthermore, women when compared with men tend to gain more weight and even lead an inactive life as a result of some factors, which include pregnancy and resulting challenges of lactation, unhealthy eating habit and domestic chores. Weight gained by urban females in the listed processes sometimes becomes very difficult to shed. This condition obviously predisposes more women

than men to low levels of cardiorespiratory fitness. It is against this background that my research works focused on women and later on men.

In 2003, a cross population study of selected American and Nigerian female adults was conducted in order to compare the cardiovascular health status and body composition of the two groups. Participants' body fat percentage and resting values of heart rate, blood pressure and VO_2max were measured. The UKK Institute's prediction equation was used to calculate a fitness index based on gender, age, body weight, time taken to walk 2km, and heart rate recorded at the end of the walk. Result showed that both groups were overweight, while some were obese. The American participants rated low on fitness index, however, when they were compared with Nigerian participants, USA participants were found to be better in all fitness variables tested.

In 2004, the University of Lagos Central Research Committee approved a research grant which was used in conducting a comparative study of the body composition and cardio respiratory fitness of non-teaching University Female staff in two Universities. A total of 81 non-teaching intermediate level female staff who volunteered and gave consent to participate in the study were screened by a Cardiologist and then measured for weight, height, body mass index and body fat percent.

Results obtained showed that there was no difference in the weight, height, body mass index (BMI), percent fat, resting heart rate and maximum oxygen consumption between University of Lagos (UNILAG) and Lagos State University (LASU) female staff. Significant differences were observed in age, exercise heart rate, resting systolic

and diastolic blood pressures and fitness index. Both groups rated very low in fitness classification and were found to be overweight and obese. Electrocardiographic (ECG) findings revealed that some participants had systolic hypertension, diastolic hypertension, tachycardia and bradycardia. Participants were advised to change their lifestyle.

In order to assist the above participants who showed keen interest in the improvement of their cardiovascular health through exercise, I authored a book titled, 'Walking for Fitness'. The book explained how walking exercise can be adopted as a simple and an enjoyable means of enhancing physical fitness. As the author, I discussed how, where, and the appropriate materials needed for an effective walking programme.

In the same year, the extract of this book was published and circulated to members of the University of Lagos staff upon the request of the management team of the University during the tenure of one of our former Vice-chancellors, Prof. Oyewusi Ibidapo-Obe. This was an attempt by the management to combat the trend of early death trend as a result of hypokinetic diseases among University Staff. Furthermore, the need to improve the projected life expectancy at birth of Nigerians inspired me to write on "Achieving a Lifestyle of Wellness". The text highlighted the meaning and dimensions of wellness, the role of physical activities and nutrition in disease prevention and stress management.

Males

The maximum oxygen consumption (VO_{2max}) of men was measured in order to determine the capacity of the heart, lung and blood to transport oxygen to the working muscles and its utilisation during exercise. While field methods were adopted in the previous research works,

the laboratory method was adopted in evaluating the cardiorespiratory endurance of young men. The method is a rigorous one which is not very convenient for participants, the death rate of participants was found to be very high in the study sample. The study was undertaken to assess the aerobic capacity of healthy African males residing in Cedar Falls, Iowa, U.S.A using actual and scientific measure of maximum oxygen consumption (VO_2max). Participants VO_2max was determined using single stage treadmill walk test. The highest volume of oxygen during one minute of testing was monitored and recorded as the VO_2max . Heart rate was monitored and recorded throughout the test. Subjects recovered on the treadmill walking at 2.5 mile per hour on a flat treadmill with facemask removed until heart rate has returned to warm-up period. Results shows that participants rated average on VO_2max index and were advised to exercise regularly.

In 2001, I developed a structured exercise programme for the rehabilitation of drug addicts. Rehabilitated drug addicts at Adeniji Adele Rehabilitation Centre (Phase II), Lagos, were subjects of this study. The variables examined in this study were haematocrit, haemoglobin concentration, systolic and diastolic blood pressure and health-related fitness variables of cardio-respiratory endurance, percentage body fat, flexibility, muscular endurance which were affected through the drugs abused by the participants. The findings of this study indicated that a 12-week structured exercise programme had positive significant effects on haematocrit and resting systolic and diastolic blood pressures (reduced), cardio-respiratory functions, percentage of body fat abdominal muscular strength and flexibility. Therefore, structured exercise was recommended as part of the rehabilitation process of drug addicts.

Children and Adolescents

The physical activity level of children and adolescents is another research dimension which is attracting more attention largely because of the changing lifestyles that have threatened the opportunity to be active and has also introduced attractive sedentary alternatives. Research has shown that children and adolescents have become less active to the point where it is seriously damaging their current and future health. Otiwa and Owolabi (2008) compared the anthropometric, central adiposity and hip adiposity of adolescents who are in Junior and High schools in Nigeria and Botswana. Results indicated that significant differences existed in the BMI, waist circumference and body fat percent between adolescents from the two countries. These findings were used for comparative cross cultural analysis between the cohorts, stating the implications for obesity and recommendations on healthy living, positive active lifestyle and possible development of government health policies that will enhance adolescent health.

I studied in 2010 the impact of physical education practical classes on the health of school children. The study determined whether there was any significant difference in the physical activity pattern of adolescents in low and high fee paying schools. Results showed that there is a wide gap between the schools compared in the areas of organised physical activities, time allotted on the school time-table for the teaching of PE, adequacy of facilities, and frequency of after school sporting programmes. All these are in favour of the high fee paying schools and are therefore found to be meaningfully engaged in physical exercise on a regular basis.

Athletes

The shift in research focus to athletes was caused by the incidence of a sudden collapse and death of athletes during training and competitions as reported by media houses. Notable among these athletes are Kanu Nwankwo who had heart problems and Sam Okparaji who died during an international soccer match. This generated the curiosity to know the status of the cardio respiratory functions of athletes, especially footballers because of the premium placed on the sport "football" nationally and internationally.

Otinwa and Onyeudo (2009) determined the $VO_2\text{max}$ of Union Bank Football Club of Lagos and examined whether there were differences due to positional play. Thirty-five players who volunteered (5 goal keepers, 10 defenders, 10 midfielders, and 10 attackers) were studied. The $VO_2\text{max}$ of each player was determined using a standard predictive equation. Other tested parameters like resting heart rate did not show any significant differences when different positions were compared i.e. goalkeepers, midfielders, strikers and defenders. However, the goalkeepers (who had a mean BMI of 25.96kg.m^2) were found to have a significantly higher BMI than the rest of the team. The study showed that position on the field of play has no significant relationship with physiological parameters like resting heart rate and maximal oxygen uptake while physical characteristics such as BMI have significant relationships with positions played on the field. It was recommended that training be individualised in team sports in which positional play is emphasised. This is particularly important considering that indices for high performance like skill acquisition is best impacted under such setting.

In 2013, Azubike and I assessed the fluid hydration level of selected Nigerian footballers. Adequate fluid hydration is known to prevent heat injury and exhaustion. It has been observed that some Nigerian athletes have collapsed during competition. These might be due to tropical fatigue and reduction in hydration level. Participants were 30 footballers from Shooting Stars Sport Club (3SC) of Ibadan, Nigeria. Data collected include anthropometric measures of body weight, body mass index, percentage body fat, lean body mass and visceral fat, resting systolic and diastolic blood values, fasting blood sugar test for nutritional status of footballers and urine test for hydration status. Findings indicated that participants were dehydrated and therefore would need fluid replacement during play in order to improve performance and prevent dehydration. It was recommended that athletes should consume an adequate amount of fluid before and at regular intervals during exercise in order to delay the depletion of glycogen stores and replace water lost in sweat coupled with hot weather conditions.

Current Research

Presently, my colleagues and I are presently involved in developing a Physical Activity Intervention programme in collaboration with HOPSports, Company, USA. This programme intends to provide an opportunity for children to learn sports and movement in the classroom/gymnasium from different countries with different cultures through interactive technology in the cyber world. Moderate-intensity and Vigorous-intensity physical activity is being designed to stimulate the cardiorespiratory and muscular responses of children.

Globally, health and physical education programmes are faced with the challenge of providing meaningful and

relevant learning experiences. Children and youths of the 21st Century must be adaptable and adept in the following learning strategies and skills: critical thinking and problem solving, operate with agility and adaptability, effectively analyse information, communicate in various oral and written forms, reflect greater curiosity, demonstrate imaginative and innovative thinking, and develop healthy and active lifestyles in support of well-being and academic success. Now, more than ever, there is a need for a broader global/international perspective of health and physical education pedagogy, reflective of a world in flux. Without question, knowledge of global/international practices will assist in advancing health and physical education pedagogy worldwide.

The above justifies the need to come up with the book "Physical Education and Health: Global Perspectives and Best Practices" in which I am a lead author in one of the chapters titled, "Evolution of Best Practices in the Delivery of Quality Physical Education Programmes in Nigeria". Other contributors comprised 108 scholars representing 67 universities/institutions and schools from 40 countries. The main focus of the contributions include: unique curricular models of each country's contemporary as well as future strategies including technology, teacher-student learning engagement, the structure of classrooms, the integration of physical education and health in the community;

Conclusion

As an Exercise Physiologist, I have come to the conclusion that the pursuit of wellness and longevity requires an individual to constantly and deliberately make efforts to stay healthy and achieve the highest potential for well-being. This involves engaging in attitudes and behaviours that enhance one's quality of life and

maximise personal potential. However, though wellness implies working toward a highly developed level of health, it does not mean that an individual will make the best choice in every situation or that "perfect wellness" is achievable. Wellness emphasises the need to take responsibility for engaging in behaviours such as active participation in exercise and adequate nutrition that develops optimal health.

The process of achieving optimal wellness involves a balance and maintenance of its essential dimensions which include social, spiritual, intellectual, emotional, environmental, occupational and physical. Each dimension is equally vital in the pursuit of optimum health, but to an Exercise Physiologist, physical wellness ranks first and is therefore considered the most important dimension. This is because working to enhance one's physical wellness contributes to the improvement of other aspects of wellness.

In conclusion, this lecture has pointed our attention to the global epidemic of physical inactivity, overweight and obesity from the perspectives of an Exercise Physiologist. This epidemic condition is as a result of an imbalance in dietary energy intake and energy output. The burden of this epidemic condition on the human body has led to many crises which are manifest in disease conditions like metabolic syndrome, cardiovascular diseases exemplified by hypertension, diabetes, and death in some cases. These conditions are preventable. Other social economic impacts include huge medical cost, psycho-social problems, low productivity and a poor economy. Researchers have established exercise as a preventive and therapeutic medicine in the management of hypokinetic diseases. Therefore, inactive individuals should make a concerted effort to participate in regular

exercise programmes which are most preferred when compared with drug therapy with its adverse side effects. To improve the life expectancy of Nigerians, which is presently 52years, Nigerians must rise up and overcome the barriers hindering regular participation in exercise, thereby striking a balance in the diet and exercise equation. Regular exercise is a very strong factor in the maintenance, preservation, and promotion of quality living and longevity. More importantly, it leads to a healthy and productive life in all aspects of living – academics, sports, labour and all skills.

Recommendation: Clarion Call for Action

The Bible says wisdom is better than the weapons of war (Ecclesiastes. 9:18a, King James Version) and physical exercise has some value (I Timothy 4:8a, King James Version). Considering the numerous benefits of leading an active lifestyle, it is therefore wise to embrace an exercise as our choice option over the experience of pain from diseases; as well as the ingestion of drugs and its side effects. My recommendations are based on the fact that physical activity has suffered from paradigm paralysis.

Therefore, there must be a paradigm shift in the order presented below:

Individuals

It is for all the health benefits, and more, that individuals should limit energy intake from total fats; increase consumption of fruit and vegetables, as well as whole grains. Limit the intake of salt and sugars; and most importantly adopt a physical active lifestyle in order to achieve energy balance and a healthy body weight.

University of Lagos

Mr. Vice Chancellor Sir, while appreciating the efforts of the University management in ensuring that all staff and students go for regular medical check-ups, the University management should promote an active lifestyle of her staff and students by providing a number of well equipped gymnasias on campuses and more open spaces for sports and active recreational activities. This service should be extended to members of the public and may serve as an asset for research purposes and a source of revenue for the University. It will then be said that the town and gown have met. Independent of the above, the University setting is considered an ideal environment for the promotion of healthy lifestyle.

The Department of Human Kinetics and Health Education is an important asset of this University which I suggest should be optimally utilised by empowering her to revisit, organise, and manage a campus wide aerobic exercise programmes. This will solve the problem of access and exercise skill acquisition by members of this community. There should be academic, research and referral links among the medical centre, Lagos University Teaching Hospital (LUTH) and the department. The Exercise Physiology Unit of the Department is readily available to render consultancy services on exercise prescription and exercise therapy.

In the area of manpower and capacity building, it has been observed that there are very few Exercise Physiologists in Nigeria. This created a vacuum opening up an opportunity for quack fitness instructors to prescribe and administer exercise programmes in different settings. Unqualified fitness instructors have harmed many individuals and even discouraged people from participating in regular exercise programmes owing

to injuries sustained from wrong exercise. The Department is therefore working towards the approval of a Postgraduate Diploma in Exercise Prescription and Management. This will consequently meet the needs of many people in the society who are desirous of undertaking healthy exercise programmes. This I hope will be implemented very soon.

Professionals in Human Kinetics, Health, Recreation, Sports and Dance

Professionals in Human Kinetics, Health, Recreation, Sports and Dance must have a paradigm shift in the content and methodology of teaching school age children by providing the right environment for learners to live in an ever-changing world through innovative and technological strategies that allows for all-round development of school children.

Federal and State Interventions

Obesity and related health problems are preventable global epidemics. They result from direct and indirect behaviours of adults. Prevention of childhood obesity will require interventions at behavioural, legal and policy levels extending to the domains of homes, schools and states that are attuned to the needs and resources of the individual, community, and nation.

Alternatively, a guiding national policy within which the promotion of physical activity is defined as a priority area of action can foster the implementation of physical activity interventions. A guiding policy may be a national action plan or strategy on the prevention and control of NCDs and health promotion or physical activity promotion in particular.

Network of Stakeholders

A network of relevant stakeholders (e.g. Ministries, Private Sector Organisations, State Sporting Associations, schools, employers, parents, local community groups) is necessary for implementing physical activity interventions in specified settings (such as the community and workplace). Education on the benefits of exercise and the harm of physical inactivity

should be publicised through electronic, print and other social media.

The introduction and the expansion of the Physical Education (PE) programme should be compulsory in schools from pre-primary and primary to the senior secondary school level, making recreation periods compulsory in all schools, thereby encouraging children to pursue physically active lifestyle.

National Physical Activity Guidelines: National guidelines on physical activity for the general population or specific population groups (e.g. Children, adolescents, and older people) are important to educate the population on the frequency, duration, intensity and types of physical activity necessary for health.

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