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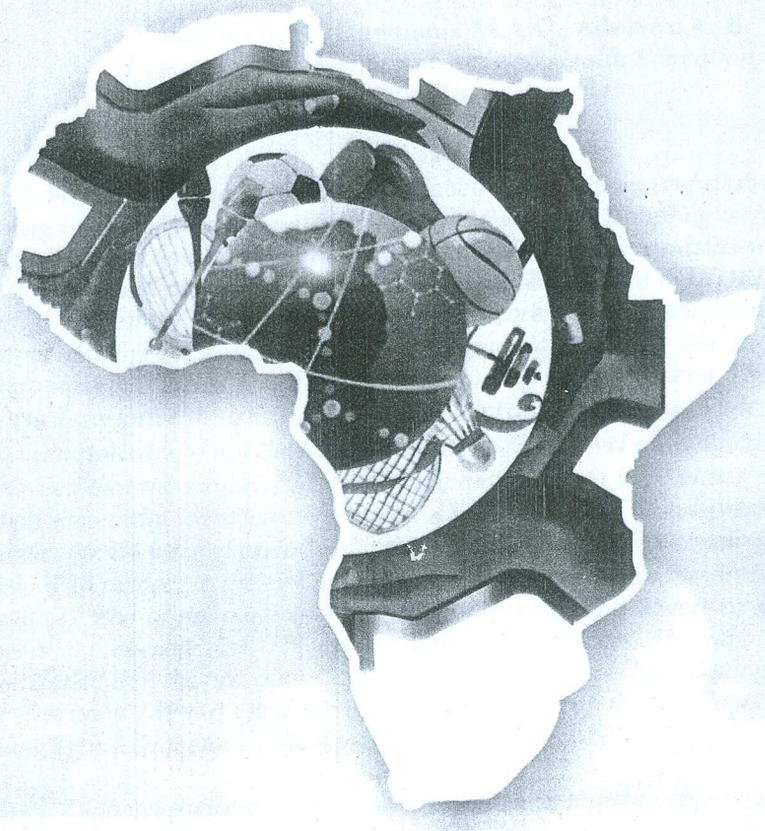

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AN ASSESSMENT OF THE PREVALENCE OF DIABETES MELLITUS AND ITS RISK FACTORS AMONG PEOPLE LIVING IN ABUJA, NIGERIA

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Abstract
This survey investigated the prevalence of diabetes risk factors and diabetes mellitus among people living in Abuja. Using Simple Random and Purposive Sampling techniques for selecting geographical region and participants respectively, 417 Abuja residents were selected for the study. A standardized instrument - Finnish Diabetes Risk Score (FINDRISC) questionnaire - was used to determine the total diabetes risk score of the participants. In addition, the participants' demographic information and biometric variables like blood pressure, blood sugar, body mass index (BMI), and waist circumference were measured. The collected data were subjected to descriptive statistics of frequency count and percentage, while Chi square was used for inferential statistics to test the hypotheses at $P \leqslant 0.05$ level of significance. The result of the study revealed that the majority of the participants (66.7%) were either overweight or obese, 46.1% had unhealthy waist circumference, 43.9% had high blood pressure, 2.4% had high blood sugar; 66.4% were physically inactive, while 77.5% did not consume vegetables or fruits every day. With respect to the risk scores of developing diabetes mellitus in the next 10 years, about half (49.9%) of the participants were at low risk, 30.9% were at slightly elevated risk, 11.7% were at moderate risk, 7% were at high risk, and only 0.5% were at very high risk. The study concluded that the prevalence of diabetes risk factors is high among residents of Federal Capital Territory (Abuja), and a significant number of the residents are at high risk of developing Type 2 Diabetes mellitus in the next 10 years.

Keywords: *Diabetes mellitus, Risk factors, prevalence, high blood pressure, Body Mass Index, physical activity.*

Introduction

Diabetes mellitus is now one of the most common non-communicable diseases worldwide. Globally, it is the third leading cause of premature death, after high blood pressure and tobacco use (World Health Organization – WHO, 2009); and according to the International Diabetes Federation (IDF) (2013), no country, and increasingly few communities, are unaffected by the

disease.

The Scottish Intercollegiate Guidelines Network (2010) defined diabetes mellitus as a metabolic disorder of multiple aetiology characterised by chronic hyperglycaemia with disturbances of carbohydrate, protein and fat metabolism, resulting from defects in insulin secretion, insulin action, or both. Diabetes mellitus is classified on the basis of aetiology and clinical presentation of the disorder into four types: type 1 diabetes mellitus, type 2 diabetes mellitus, gestational diabetes, and other specific types. Sicree, Shaw and Zimmet (2009) observed that type 2 diabetes mellitus (T2DM) constitutes about 85 to 95% of all diabetes cases. The common signs and symptoms of diabetes mellitus include: polyuria (excessive urination), polydipsia (excessive thirst), polyphagia (excessive hunger), and significant weight loss. On the other hand, the common complications of diabetes mellitus include: nephropathy (kidney damage), retinopathy (damage to the retina of the eyes), neuropathy (damage to the nervous system), chronic leg ulcer and amputation. T2DM in particular is now a common and serious global health problem, which for most countries, have evolved in association with rapid cultural and social changes, ageing populations, increasing urbanization, dietary changes, reduced physical activity and other unhealthy lifestyles and behavioural patterns.

As noted by the IDF (2015), the escalating prevalence of type 2 diabetes (T2DM) is threatening to undermine healthcare systems and development goals throughout the world, with the IDF's (2015) latest estimate suggesting that about 415 million people or 8.8% of adults are already living with diabetes worldwide. A further 318 million people are with Impaired Glucose Tolerance (IGT) and are at high risk of developing diabetes in the nearest future. This estimate has been projected to increase to about 642 and 482 million people globally with T2DM and IGT respectively by the year 2040 (IDF, 2015). IDF (2015) also observed that one person presently dies every six seconds from these diabetes-related conditions, while according to IDF (2013), by the end of 2013, diabetes cost 548 billion US dollars in healthcare spending worldwide (although Africa contributed less than 1 percent of this expenditure).

The prevalence of diabetes mellitus in Nigeria was estimated to be 4.99% in the year 2013; while more than 100,000 people died from diabetes-related conditions in the country in the same year (IDF, 2013). Unfortunately, as noted by Sicree, Shaw and Zimmet (2009), many governments and public health planners in this region of the world still remain largely unaware of the current magnitude, fatality rate or, more importantly, the future potential for increase in diabetes and its serious complications in the country. Scientific projections suggested that the prevalence of T2DM will continue to increase in Nigeria and other sub-Saharan Africa (SSA) - a trend if unchecked will likely hinder the socio-economic growth of this region and prevent the achievement of the sustainable development goals (SDGs).

Since diabetes mellitus has no known cure yet, IDF (2012) argued that prevention of the disease and its complications remain the best weapons. As explained by the organization, with the right attitude and approach, most of the cases of diabetes could be prevented. This is attainable through a multipronged approach that involves firstly identifying people at high risk for T2DM, and then providing them with appropriate lifestyle intervention. In addition to these programmes, broader population-based approaches to reduce the numbers of people who become at risk of developing diabetes are needed (Alberti, Zimmet & Shaw, 2007; Ryden et al., 2007; and IDF, 2013). Hence, screening tests are needed to identify people with undiagnosed diabetes or people who are at risk for developing diabetes in the nearest future (IDF, 2013). The purpose of this study is to investigate the prevalence of diabetes risk factors, total diabetes risk scores, and Type 2 diabetes mellitus among people living in Abuja.

The following research hypotheses will be tested in the study:

1. There will be no significant cases of elevated Body Mass Index among Abuja residents.
2. There will be no significant cases of increased waist circumference among Abuja residents.
3. There will be no significant cases of high blood pressure among Abuja residents.
4. There will be no significant cases of high blood glucose among Abuja residents.
5. There will be no significant cases of physical inactivity among Abuja residents.
6. There will be no significant cases of high Type 2 diabetes risk score among Abuja residents.

Methods and Procedures

Population and Sampling

The population for this descriptive research design study was the 1,406,239 residents in Abuja (Federal Republic of Nigeria, 2009). The sample size for this study was 417 participants and was calculated using the Medical Research Sample Size Formula, $n = z2pq / d2$.

A Multi-stage Sampling technique was used. Simple Random technique was used to select Abuja Municipal Area Council out of the six area councils of Abuja. Purposive sampling technique was used to select Wuse market from the Abuja Municipal Area Council because of its centrality, and being the largest market in the area council, with the largest number of people congregating at once in Abuja. Purposive sampling technique was also used to select participants for the study. These participants were registered for free health check that started on Tuesday, 14th and ended on Thursday, 16th November, 2017 to mark the World Diabetes Day. After the programme, Simple Random sampling technique was used to select the final 417 study population from the participants that registered for the programme.

Research Instrument and Equipment

A standardized instrument, the Finnish Diabetes Risk Score questionnaire (FINDRISC), was adopted to collect data from participants. The FINDRISC questionnaire was used to collect data on eight variables which clearly correlated with the risk of developing diabetes; these are: age, body mass index (BMI), waist circumference, physical activity, nutrition, use of anti-hypertensive medication, history of elevated blood glucose, and history of diabetes in the family. Demographic data (Gender, Marital Status, Occupation, and Educational Level) were also collected from the participants. Other equipment that were used for this study were Glucometer, Sphygmomanometer, Stadiometer, non-stretchable measuring Tape, and a Weighing Scale.

Procedure for Data Collection

The World Diabetes Day comes up on the 14th of November, every year. As part of the activities set aside to mark the 2017 World Diabetes day, a 3-day free health check was organized between the 14th and 16th of November, 2017, in Wuse Market. The free health check included blood sugar check, blood pressure check, and a health counselling.

The FINDRISC questionnaire was used to evaluate the prevalence of the diabetes risk factors and total diabetes score in the participants. In order to determine the diabetes risk score in the participants, the following standard FINDRISC criteria were used: presence of family history of Diabetes mellitus (DM) was scored 3 if it occurred in the grandparent, aunt, uncle or first cousin, or 5 if it was present in the parent, brother or sister or zero (0) if there was no family history. Consumption of fruits or vegetables was scored zero (0) if the participants consumed

fruits/vegetables daily or scored 1 if they did not. Participants that take anti-hypertensive drugs on a regular basis were scored 2, those that do not were scored zero (0). Daily exercise of at least 30 minutes was scored zero (0) if positive and 2 if negative. Presence of high blood glucose in past examinations was scored 2 if it was positive or zero (0) if it was negative. Body Mass Index (BMI) <25 was scored zero (0), 25 - 29.9 was scored 1 while ⩾ 30 was scored 3. Age (in years) <45 was scored zero (0), 45-54 was scored 2, 55-64 was scored 3, while 65 and above was scored 4. Waist circumference of <95cm in a male and 80cm in a female was scored zero, 95-102cm in a male and 80-88cm in a female was scored 3 while >102cm and >88cm in a female was scored 4. The total risk score for each participant was then summated. The risk score values ranges from 0 – 20. The risk of developing type 2 diabetes within ten years was stratified into different scores: low risk (<7), slightly elevated risk (7 – 11), moderately elevated risk (12 – 14), high risk (15 – 20) and very high risk (>20).

In order to determine the prevalence of diabetes mellitus in the sample population, the researcher used a glucometer to measure the random (casual) blood glucose (RBG) of the participants. The blood glucose was determined using Accu-check Glucometers that were previously calibrated with laboratory measurements. The universal safety procedure was followed while measuring the blood glucose. Since all the participants had eaten before the study, while those that had not eaten were not able to be screened before 10 am on the day of the screening, only Random (Casual) Blood Glucose screening was done. Diabetes was diagnosed using a Random (Casual) Blood Glucose of ⩾ 11.1 mmol/L (⩾200 mg/dL), while Impaired Random (Casual) Glycaemia was defined by values ranging from ⩾ 7.8 to <11.1 mmol/L (⩾ 140 to 199.9 mmol/L). The participants with elevated blood glucose were subsequently referred to the nearest hospital for further medical evaluation.

The Sphygmomanometer was used to measure the participants' blood pressure by trained research assistants in accordance with standard procedure. High blood Pressure was defined as systolic blood pressure ⩾ 140 mmHg and/or diastolic blood pressure ⩾ 90 mmHg, or being on pharmacological treatment for systemic hypertension. The participants with elevated blood pressure were subsequently referred to the nearest hospital for further medical evaluation.

Height was measured to the nearest 0.1 cm using a Stadiometer, while Weight was measured in kilograms, to the nearest 0.1 kg, using a Weighing Scale, and the researcher ensured that the participants wore light clothing and were without shoes. The body mass index (BMI) was calculated using the formula: Weight (kg) / Height2 (m). Overweight and generalized obesity was defined as BMI ⩾25 and 30 kg/m2 respectively.

Also, a non-stretchable measuring tape was used to measure the participant's waist circumference to the nearest 0.1cm, while the subjects were standing in erect posture. Measurement was taken midway between the lowest rib and iliac crest. High or increased waist circumference was defined as waist circumference of ⩾ 102 cm in men and ⩾ 88 cm in women.

For ethical considerations, a letter seeking written ethical clearance was gotten from the Health Research and Ethical Committee of the National Hospital, Abuja. Ethical standards were also followed in accordance with the World Medical Association Declaration of Helsinki of 1975, as revised in 2000 (WHO, 2001). Administrative approval for the project was also obtained from the management of Wuse Market. The concept of the study was explained to the participants, and their written and verbal informed consents were collected before they were enrolled into the study.

Procedure for Data Analysis

The data collected from participants were subjected to descriptive statistics of frequency count and percentage. The Chi-square was used for inferential statistics to test the hypotheses at $P \leq 0.05$ level of significance. The Statistical Package for Social Science (SPSS) for Windows, version 15 software (SPSS Inc., Chicago, IL) was used to analyse the data. The data was expressed as mean ± SD. A pilot study was carried out among 20 residents of Lafia Local Government Area of Nassarawa State, Nigeria.

Results

Table 1: Socio-Demographic Distribution of Participants

Variable	Responses	Frequency	Percentage (%)
Gender	Male	226	54.2
	Female	191	45.8
Age	< 45 years	229	54.9
	[illegible]	131	31.4
	55 – 64 years	43	10.3
	> 64 years	14	3.4
Marital Status	Single	150	36.0
	Married	259	62.1
	Divorced	6	1.4
	Widowed	2	0.5
Educational Level	None	12	2.9
	Primary	89	21.3
	Secondary	259	62.1
	Post-Secondary	57	13.7
Occupation	Student	37	8.9
	Artisan/Unemployed	32	7.7
	Business/Trading	195	46.7
	Civil Servants	66	15.8
	Private Organization Employee	87	20.9
		n – 417	

Table 1 shows that the male population (54.2%) of the study was slightly more than the female population (45.8%). The mean age of the participants was 36.2 years with most (54.9%) of the participants being below 45 years of age which can be considered to be young; while only 3.4% were elderly - above 64 years of age. Also, most of the participants admitted that they were married and had at least Secondary School qualification (62.1% and 75.8% respectively) while 46.7% of the participants claimed to be into business/trading for their means of livelihood.

Table 2: Biometric Measurement among the Participants

Variables	Responses	Male	Female	Total
Body Mass Index (Kg/M^2)	< 25	84(20.1%)	55(13.2%)	139(33.3%)
	25 – 30	103(24.7%)	90(21.6%)	193(46.3%)
	> 30	39(9.4%)	46(11%)	85(20.4%)
Waist Circumference (cm)	< 94 in Male and < 80 in Female	127(30.4%)	97(23.3%)	224(53.7%)
	94 – 102 in Male and 80 – 88 in Female	64(15.4%)	48(11.5%)	112(26.9%)
	> 102 in Male and > 88 in Female	35(8.4%)	46(11%)	81(19.4%)
Blood Pressure (mm/Hg)	Normal: < 120/< 80	61(14.6%)	64(15.4%)	125(30%)
	Pre – Hypertension: 120 – 139/80 – 89	59(14.2%)	50(11.9%)	109(26.1%)
	Stage 1 Hypertension: 140 – 159/90 – 99	71(17%)	53(12.7%)	124(29.7%)
		35(8.4%)	24(5.8%)	59(14.2%)
Random Blood Glucose (mg/dL)	Normal: ⩽ 61- 139	207(49.6%)	180(43.2%)	387(92.8%)
	Impaired: ⩾ 140 – 199.9	12(2.9%)	8(1.9%)	20(4.8%)
	High: ⩾ 200	7(1.7%)	3(0.7%)	10(2.4%)

Table 2 shows that the majority of the participants (66.7%) were either overweight or obese, while the males (20.1%) had slightly more healthy weight compared to the females (13.2%). Almost half (46.1%) of the participants had unhealthy waist circumference. Also, 43.9% of the participants had elevated blood pressure; this is noticed to be more in the males (25.4%) compared to the females (18.5%). Random Blood Glucose (RBG) measurement shows that 2.4% of the participants had high blood glucose, which is noticed to be more in the males (1.7%) compared to the females (0.7%).

Table 3: Lifestyle History among the Participants

Variables	Responses	Male	Female	Total
	Yes	74(17.8%)	66(15.8%)	140(33.6%)
	No	152(36.4%)	125(30%)	277(66.4%)
Frequency of Vegetables or Fruits Consumption	Every Day	42(10.1%)	60(14.4%)	102(24.5 %)
	Not Every Day	184(44.1%)	131(31.4%)	315(75.5%)

n – 417

Table 3 shows that the majority of the participant's lifestyle is unhealthy. 66.4% were physically inactive, while 77.5% did not consume vegetables or fruits every day. These unhealthy lifestyles were noticed to be more in the males (54.2%) than the females (45.8%).

Table 4: Health and Family History among the Participants

Variables	Responses	Male	Female	Total
History of Regular use of Anti-Hypertensive	No	187(44.8%)	141(33.8%)	328(78.6%)
	Yes	39(9.4%)	50(12%)	89(21.4%)
History of High Blood Glucose	No	221(53%)	184(44.1%)	405(97.1%)
	Yes	5(1.2%)	7(1.7%)	12(2.9%)
Family H istory of Diabetes mellitus	No	166(39.8%)	144(34.5%)	310(74.3%)
	Yes: Grandparent, Aunt, Uncle or First Cousin	39(9.4%)	25(6%)	64(15.4%)
	Yes: Parent, Brother, Sister or Own Child	21(5%)	22(5.3%)	43(10.3%)

n - 417

Although 43.9% of the participants had elevated blood pressure (Table 2), table 4 shows that only 21.4% of the participants took anti-hypertensive medications on a regular basis. Also, only 2.9% of the participants had ever been found to have high blood glucose, while only about one quarter (25.7%) of the participants had known family history of diabetes mellitus.

Table 5: Total Risk Score of Type 2 Diabetes mellitus among the Participants

Variables	Responses	Male	Female	Total
Total Risk Score of Type 2 Diabetes mellitus	Low (< 7)	115(27.6%)	93(22.3%)	208(49.9%)
	Slightly Elevated (7 – 11)	70(16.8%)	59(14.1%)	129(30.9%)
	Moderate (12 – 14)	22(5.2%)	27(6.5%)	49(11.7%)
	High (15 – 20)	19(4.6%)	10(2.4%)	29(7%)
	Very High (> 20)	0(0%)	2(0.5%)	2(0.5%)

With respect to the risk of developing diabetes mellitus in the next 10 years among the participants, about half (49.9%) of the participants were at low risk, 30.9% were at slightly elevated risk, 11.7% were at moderate risk, 7% were at high risk, and only 0.5% are at very high risk of developing diabetes mellitus in the next 10 years. The high to very high risk scores was noticed to be higher in the male gender (4.6%) compare to the females (2.9%).

4.2 Testing of Hypotheses

Hypothesis One: There will be no significant cases of elevated Body Mass Index among Abuja residents.

Table 6: Chi-Square Analysis of Cases of Elevated Body Mass Index

Variables	N	Mean	S.D	X^2Calc	X^2tab	Df	Remark	Decision
Elevated Body Mass Index	417	1.07	1.07	41.957	5. 99	2	Significant	Rejected

From Table 6 above, the X2 calc 41.957 is greater than X2 tab 5. 99. The null hypothesis is therefore rejected while the alternate hypothesis which states that there will be significant cases of elevated Body Mass Index (BMI) among Abuja residents is accepted at 95% Alpha level.

Hypothesis Two: There will be no significant increased waist circumference among Abuja residents.

Table 7: Chi-Square Analysis of Increased Waist Circumference

Variables	N	Mean	S.D	X^2Calc	X^2tab	Df	Remark	Decision
Increased Waste circumference	417	1.07	1.07	84.705	5. 99	2	Significant	Rejected

From Table 7 above, the X2 calc 84.705 is greater than X2 tab 5. 99. The null hypothesis is therefore rejected while the alternate hypothesis which states that there will be significant increased waist circumference among Abuja residents is accepted at 95% Alpha level.

Hypothesis Three: There will be no significant cases of high blood pressure among Abuja residents.

Table 8: Chi-Square Analysis of Cases of High Blood Pressure

Variables	N	Mean	S.D	X^2Calc	X^2tab	Df	Remark	Decision
Cases of High Blood Pressure	417	2.28	1.067	30.64	7.81	3	Significant	Rejected

From Table 8 above, the X2 calc 30.64 is greater than X2 tab 7.81. The null hypothesis is therefore rejected while the alternate hypothesis which states that there will be significant cases of high blood pressure among Abuja residents is accepted at 95% Alpha level.

Hypothesis Four: There will be no significant cases of high blood glucose among Abuja residents.

Table 9: Chi-Square Analysis of Cases of High Blood Glucose

Variables	N	Mean	S.D	X^2 Calc	X^2tab	Df	Remark	Decision
Cases of High Blood Glucose	417	1.09	0.343	674.978	5. 99	2	Significant	Rejected

From Table 9 above, the X2 calc 674.978 is greater than X2 tab 5. 99. The null hypothesis is therefore rejected while the alternate hypothesis which states that there will be significant cases of high blood glucose among Abuja residents is accepted at 95% Alpha level.

Hypothesis Five: There will be no significant cases of physical inactivity among Abuja residents.

Table 10: Chi-Square Analysis of Cases of Physical Inactivity

Variables	N	Mean	S.D	X^2Calc	X^2tab	Df	Remark	Decision
Cases of Physical Inactivity	417	1.33	0.946	45.01	3.84	1	Significant	Rejected

From Table 10 above, the X2 calc 45.01 is greater than X2 tab 3.84. The null hypothesis is therefore rejected while the alternate hypothesis which states that there will be significant cases of physical inactivity among Abuja residents is accepted at 95% Alpha level.

Hypothesis Six: There will be no significant cases of high risk scores of Type 2 diabetes mellitus among residents in Abuja.

Table 11: Chi-Square Analysis of High Risk of Type 2 Diabetes mellitus

Variables	N	Mean	S.D	X^2Calc	X^2tab	Df	Remark	Decision
High risk Scores of Type 2 diabetes	417	1.77	0.939	342.628	9.49	4	Significant	Rejected

From Table 11 above, the X2 calc 342.62 is greater than X2 tab 9.49. The null hypothesis is therefore rejected while the alternate hypothesis which states that there will be significant high risk of Type 2 diabetes mellitus among residents in Abuja is accepted at 95% Alpha level.

4.3 Discussion of Findings

The study which investigated the prevalence of diabetes mellitus, its risk factors, and total diabetes risk scores among Abuja residents came up with some interesting findings. As seen in Table 2, the study showed that the majority of the participants (66.7%) were either overweight or obese, while the males (20.1%) had slightly more healthy weight compared to the females (13.2%). This finding is statistically significant according to Table 6. The elevated BMI noticed among the participants might not be unrelated to the fact that the participants are living in an urban settlement. Living in the urban communities has been associated with unhealthy environmental factors that promote poor diet and physical inactivity. According to Alberti, Zimmet, and Shaw (2007); Cristina et al. (2014); World Health Organization (WHO) (2016) people living in urban communities are at greater risk of being overweight and obese due to increase exposer to certain unhealthy factors like intake of energy dense drinks and increase sedentary lifestyle. Overweight and obesity have also been categorized not only as major but also as one of the three most significant risk factors for non-communicable diseases (NCDs) such as cardiovascular diseases, Type 2 diabetes mellitus (T2DM), musculoskeletal disorders, and certain cancers (Alberti, Zimmet, & Shaw, 2007; WHO, 2016).

Similar to this study, some local studies that use the FINDRISC questionnaire, have also observed significantly elevated Body Mass Index (BMI) in population residing in urban and semi-urban communities in Nigeria. Using the FINDRISC questionnaire, Alebiosu et al. (2013)

noticed that 48.9% of their study population in Ogun State had elevated BMI, while Agu, Agu, and Nnaji (2015), observed that 42.6% of the study population in Onitsha, Anambra State were obese. These findings are also similar to the result of an international study that uses FINDRISC questionnaire in Colombia. The researchers noticed that 54% and 65% of the men and female population in the study had elevated BMI respectively (Barengo et al., 2013). All these findings, suggested that there exist significantly elevated BMI in Abuja, a factor that has strong positive correlation with Type 2 Diabetes mellitus (T2DM).

Also from Table 2, almost half (46.1%) of the participants in this study had unhealthy waist circumference. This finding is statistically significant (Table 7), but lower to the findings of Agu, Agu, and Nnaji (2015), in a local study that uses the FINDRISC questionnaire in an urban community of Onitsha, Anambra State, in which the study population had a significantly elevated waist circumference of 74.0%. According to Alberti, Zimmet, and Shaw (2007), although genes predispose an individual to diabetes, activation of a genetic predisposition requires the presence of environmental and behavioural factors, particularly those associated with lifestyle. The most significant of these factors are overweight/obesity, abdominal obesity and physical inactivity. According to the National Institute of Health (NIH) (1998); WHO (2008), the waist circumference is positively correlated with abdominal fat content. It provides a clinically acceptable measurement for assessing a patient's abdominal fat content before and during weight loss treatment. Hence, the presence of excess fat in the abdomen out of proportion to total body fat is an independent predictor of risk factor for T2DM and many other NCDs. Evidence from epidemiological studies also indicates that a high waist circumference is associated with an increased risk for T2DM, dyslipidemia, hypertension, and CVD. This increased risk is valid even in people with normal BMI (NIH, 1998).

As explained by Rigby and James (2003); WHO (2008), the measurement of abdominal obesity is better than BMI as predictors of CVD and T2DM risk, although combining BMI with waist circumference measurement may improve their discriminatory capability. Hence, central obesity is an important risk factor for T2DM even after controlling for age, smoking and family history (WHO, 2008). This significantly elevated waist circumference in Abuja, coupled with the findings of other similar studies on urban population, suggested that people in Abuja are at high risk of developing T2DM compared to other population in the country.

Hypertension (high blood pressure) is a major health problem throughout the world. This is due to its high prevalence in many parts of the world, and its association with increased risk of cardiovascular diseases and T2DM (Alberti, Zimmet, & Shaw, 2007; WHO, 2005). As further explained by the NIH (2002); WHO (2005), hypertension is part of the constellation of series of risk factors in one individual that are jointly called metabolic syndrome. The other risk factors in this constellation are abdominal obesity, dyslipidaemia and insulin resistance. The presence of this metabolic syndrome in an individual has been noticed to be associated with a 5- to 9-fold increased risk of developing T2DM (WHO, 2005). According to the finding of the study (Table 2), 43.9% of the participants had high blood pressure. This is noticed to be statistically significant (Table 8). This finding might be due to the unhealthy lifestyle and hazardous workplace environment that is associated with urban communities (WHO, 2016). The result of this study is higher than that of a similar FINDRISC-based local study that noticed hypertension prevalence of 27.7% among the study population (Alebiosu et al., 2013). The significantly high

prevalence of high blood pressure among the study population, a major risk factor for T2DM, suggested that prevalence of T2DM will likely increase in Abuja Metropolis in the nearest future if the status quo remains unchanged.

According to the study, only 2.9% (Table 4) of the participants had been found to have high blood glucose (e.g. in a health examination, during an illness, or during pregnancy). This result is lesser than the findings of similar FINDRISC-based local studies that found 5.9% and 17.5% history of any form high blood glucose in the study population in Ogun state (Alebiosu et al., 2013), and Anambra State, Nigeria (Agu, Agu, & Nnaji, 2015) respectively. According to the Diabetes United Kingdom (2009); European Society of Cardiology (ESC) and European Association for the Study of Diabetes (EASD) (ESC & EASD, 2007); International Diabetes Federation (IDF) (2015), in the absence of intervention, the majority of individuals with history of Impaired Glucose Regulation (IGR) are likely to develop T2DM in the nearest future. As further alluded by IDF (2015), people with history of pre-diabetes (impaired glucose tolerance (IGT) or impaired fasting glucose [IFG]) or with history of gestational diabetes, share many characteristics with a confirmed type 2 diabetes, which is associated with advancing age and the inability of the body to use the insulin it produces. IDF (2015) further informed that not everyone with pre-diabetes or gestational diabetes goes on to develop type 2 diabetes; a large body of evidence supports the effectiveness of lifestyle interventions – healthy diet and physical exercise – in preventing the progression to diabetes . Hence, lifestyle intervention can lead to normalization of glucose tolerance in many people with history of elevated blood glucose at some point in their life (IDF, 2015).

About one quarter (25.7%) of the participants had known family history of diabetes mellitus (15.4% in the first degree relatives and 10.3% in other relatives) (Table 4). This finding is higher than the results of a similar FINDRISC-based local study in Ogun state Nigeria that noticed that 10.5% of the participants had family history of diabetes mellitus (6.7% had first degree family history of diabetes, and 3.8% in other relatives) (Alebiosu et al., 2013). The finding of this study is however lower than the result of a similar FINDRISC-based local study in Anambra State, Nigeria, that noticed that 36.4% of the study population had positive family history of Diabetes Mellitus (28.0% in the first degree relatives, and 8.4% in other relatives) (Agu, Agu, & Nnaji, 2015). It is also lower than the result of a FINDRISC-based international study conducted in Colombia, which noticed that approximately 40% of the people surveyed had family history of T2DM (Barengo et al., 2013). Many authorities (Alberti, Zimmet, & Shaw, 2007; IDF, 2015) have identified genetics and family history of diabetes as an important risk factor in the development of diabetes and that their presence significantly increases the risk of an individual developing T2DM in the nearest future.

The prevalence of screening – detected T2DM in the study population was 2.4% (1.7% in male and 0.7% in female) (Table 2). This finding is however statistically significant (Table 9). The result of this study is lower than the findings of other similar local and international studies that were conducted on urban population (Alebiosu et al., 2013; Sabir, Isezuo, & Ohwovoriole, 2011; Barengo et al., 2013). The prevalence of diabetes in the study conducted by Alebiosu et al. (2013) in Ogun state was 5.05%, by Sabir, Isezuo, & Ohwovoriole, (2011) in Sokoto was 4.6% and by (Barengo et al., 2013) in Barranquilla Colombia was 18% in males and 12% in females. As alluded by the IDF (2015), global statistics shows that currently, there are more people with

diabetes in urban than in rural areas. By 2040, the difference is expected to widen globally, with far more people in the urban communities suffering from T2DM. Also, although 54.9% of all adults in the African region live in urban areas, about 67.0% of people with diabetes are noticed to be living in the urban environments. While the early deaths associated with diabetes in Africa results from combination of factors like the rapidly changing environments and unhealthy lifestyles that is common in the urban settlements (IDF, 2015). These findings suggested that the significant case of high blood glucose among residents in Abuja is likely due to the unhealthy urban lifestyle. The significant level of most diabetes risk factors in the study population only means the prevalence of diabetes will likely increase in the nearest future in the Abuja metropolis. This situation must be mitigated to avoid healthcare crisis in this region.

The study also shows that the majority (66.4%) of the participants were physically inactive, a situation that was noticed to be more among the males (54.2%) compared to the females (45.8%) (Table 3). This finding is statistically significant (Table 10). The high prevalence of physical inactivity in the study might not be unconnected to the fact that the study was conducted in a market where most people are stationed in their respective stores with little or no need to move around. The result of this study is higher than the findings of other FINDRISC-based national studies (Alebiosu et al., 2013; Agu, Agu, & Nnaji, 2015). Alebiosu et al. (2013) noticed that 30.4% of the participants in Ogun state were physically inactive while Agu, Agu, and Nnaji (2015) observed that 38.5% of the participants of a study in an urban community in Anambra State, Nigeria, were physically inactive. The findings of this study is also in concurrence with the findings of Barengo et al. (2013) who observed that 33% of men and 20% of women in Barranquilla, Colombia reached the recommended 30 minutes of physical activity every day.

According to IDF (2015), the increasing number of people with T2DM worldwide, have been associated with some factors like the ageing populations, economic development, increasing urbanization, less healthy diets and reduced physical activity. These lifestyle factors tend to increase the risk of developing T2DM. Alberti, Zimmet, and Shaw (2007); IDF (2015) further informed that out of the lifestyle factors associated with the development of T2DM, the most important are excess body weight, physical inactivity and poor nutrition.

The Diabetes UK (2009) advises that in order to prevent T2DM, the people identified as 'at risk' of developing T2DM should embrace lifestyle changes such as healthy eating, lose weight if overweight/obese, and increased physical activity. The Diabetes UK (2009) further informed that the amount of eventual risk reduction an individual will attain will be directly related or proportionate to the magnitude of the changes in lifestyle, particularly increased physical activity. The significant sedentary lifestyle in Abuja Metropolis needs to be given appropriate attention in order to reduce the risk of T2DM in the population.

The study shows majority (77.5%) of the participants do not consume vegetables or fruits every day. This unhealthy lifestyle was noticed to be slightly more in the males (54.2%) compared to the female (45.8%) population (Table 3). This result might be due to the fact that most vegetables and fruits consumed in Abuja are brought in from other states; a situation which might make the products a bit more expensive for many residents in Abuja to purchase on a daily basis. Another explanation might be that a good number of residents in Abuja might not be aware of the enormous health benefits associated with regular consumption of vegetables/fruits; hence, they

find no reason to consume them on regular bases.
The result of this study is similar to the findings of other FINDRISC-based studies (Alebiosu et al., 2013; Barengo et al., 2013). Alebiosu et al. (2013) noticed that only 27.8% of the study population in Ogun State eats vegetables, fruit or berries every day, while Barengo et al. (2013) in another study observed that 66% of the study population in Barranquilla, Colombia consume fruits and vegetables every day.

According to IDF (2015), in most countries, Type 2 Diabetes has increased alongside rapid cultural and social changes like ageing populations, increasing urbanization, reduced physical activity, increased sugar consumption and low fruits and vegetables intake. As alluded by Alberti, Zimmet, and Shaw (2007), unhealthy diet, comprising of poor vegetables and fruits consumption, is an identified risk factor in the development of T2DM. Hence, one of the identified diabetes preventive measures include modifying unhealthy behaviours, by eating healthier foods (comprising of daily consumption of fruits and vegetables) and increasing physical activity levels (Diabetes UK, 2009; IDF, 2015). This significantly high cases of irregular vegetable or fruit consumption among the study population, is a risk factor that will likely increase the prevalence of T2DM in the people residing in Abuja unless concrete measures are taking to address the situation.

Using the FINDRISC diabetes risk scoring method, only 7.5% (4.6% males and 2.9% females) of the participants had a high to very high risk of developing Type 2 Diabetes mellitus in the next 10 years (Table 5). This finding is however statistically significant (Table 11). The significant level of high to very high diabetes risk in the study population might not be unconnected to the significantly high level of most of the diabetes risk factors that were assessed in the study.
The result of this finding is similar to the findings of some of the national and international FINDRISC-based studies that were reviewed. Alebiosu et al. (2013) noticed 8.6% high to very high risk of developing diabetes mellitus within 10 years in Ogun state, while Agu, Agu, and Nnaji, (2015) observed 9.0% high to very high diabetes risk among residents in an urban community in Anambra State, Nigeria. In another study conducted by Ishaque et al. (2016) in Pakistan, the participants had 7% high diabetes risk, and 0.41% had very high diabetes risk of developing DM in the next 10 years. The result of this study is however slightly lower than the findings of Olamoyegun, Oluyombo and Iwuala (2017) who noticed that 13.73% of the participants in Ekiti State, Nigeria had high to very high diabetes risk score.

As part of diabetes preventive measures, many authorities have recommended that the general population should be screened routinely for absolute diabetes risk. The people with elevated risk can then be screened properly for diabetes using blood test (Diabetes UK, 2009; IDF, 2015). IDF (2015) further submitted that using this method to identify people at risk of developing Type 2 Diabetes or with undiagnosed Type 2 Diabetes is not only simple, it is feasible and cost-effective, especially in resource-tight countries like Nigeria.

The only challenge is that most currently available diabetes risk score instruments only work well in populations where the risk scores were developed. As at the year 2015, diabetes risk scores had only been tested in 32 countries worldwide, with many low- and middle-income countries yet to have the data required to develop diabetes risk prediction scores for their populations (IDF (2015). Fortunately, as recognized by the IDF (2015), the Finnish Diabetes

Risk Scoring system (FINDRISC) have been tested and validated successfully in Nigeria.

Conclusion and Recommendations

The study concluded that the prevalence of diabetes risk factors is high among residents in Federal Capital Territory (Abuja), and a significant number of the residents are at high risk of developing Type 2 Diabetes mellitus in the next 10 years. Subsequently, the study recommends the following:

1. Government and all stakeholders should embark on public health campaigns to educate residents in the Federal Capital Territory (FCT), Abuja, about diabetes and how to mitigate its risk factors.
2. Government should provide policies that encourage education on healthy living (including healthy food options and adequate physical activity) in the schools and workplaces in the FCT (Abuja).
3. Government should provide policies and incentives (including taxes) to reduce consumption of sugar-sweetened beverages and high sugar foods in FCT Abuja.
4. Government should provide incentives to increase the availability and affordability of leafy vegetables and fresh fruits within the FCT Abuja.
5. Government should provide policies that encourage adequate physical activity within the FCT Abuja.
6. Government should provide medium for residents in FCT Abuja to access more health education materials on healthy living and disease prevention.
7. Government should make the FINDRISC questionnaire available in all the healthcare and public facilities in the FCT, Abuja, and encourage the people to be screened for diabetes risk on regular bases. Diabetes prevention education program should be set up for the people found to be at high risk of developing the disease condition.
8. Government and all stakeholders should embark on further researches on how to make the FCT Abuja a more health-promoting city.

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