Texila International Journal of Public Health
Volume 7, Issue 2, Jun 2019

Prevalence and awareness of Diabetes Mellitus in Rural Communities of Abuja Nigeria

Article by Orji Ikechukwu Anthony[1], Ojji Dike Bevis[2], Ikechukwu-Orji Mercy Uchechi[3]
[1]*Disease Control Unit, Health Department, AMAC, Abuja, Nigeria*
[2]*Cardiology Unit, University of Abuja Teaching Hospital, Gwagwalada, Abuja, Nigeria*
[3]*Texila American University, Guyana*
E-mail: drtony2013@gmail.com[1], drtonyiyke@gmail.com[2]

Abstract

Introduction*: Globally, Diabetes mellitus is reckoned a disease of major public health concern. It is a key risk factor for heart failure, stroke and coronary artery disease. Diabetes contributes significantly to global morbidity and mortality, with more impact in developing countries such as Nigeria. In Nigeria, various studies have reported the prevalence of diabetes to vary across different zones of the country with some reporting an increasing prevalence in rural communities.*

Objectives: 1. *To determine the prevalence of diabetes in rural communities of Abuja, FCT Nigeria.* ***2.*** *To determine the awareness of diabetes in rural communities of Abuja.* ***Methodology****:*

A community-based cross-sectional study conducted in 2017 in selected communities of Abuja using a multi-stage sampling technique to sample 408 adult participants. Interviewer administered questionnaire was used to collect data and Glucometer used for blood sugar measurements following recommended guidelines while SPSS 20.0 version was used for data analysis. Univariate analysis was performed for Blood Sugar level while multivariate analyses were done to ascertain relationship of the various socio-demographic characteristics to diabetes. Results were considered significant at p-value < 0.05.

Results*: The prevalence of 4.4% was recorded for diabetes. Female sex and age 45 years and above, were independent predictors of diabetes in these group with appreciable awareness of the condition.*

Conclusion*: The study recorded an increased prevalence of diabetes in rural communities of Abuja. This calls for intensive program directed at controlling diabetes among the rural populace.*

Keywords: *Diabetes, prevalence, awareness, rural communities, Abuja.*

Abbreviations

AHA	American Heart Association
AIDS	Acquired Immune Deficiency Syndrome
AMAC	Abuja Municipal Area Council
APA	American Psychological Association
CI	Confidence interval
CVD	Cardio-Vascular Diseases
CAD	Coronary Artery Disease
DALY	Disease Adjusted Life Years
DM	Diabetes mellitus
DNA	Deoxyribonucleic Acid
EASD	European Association for the Study of Diabetes
FCT	Federal Capital Territory
FMOH	Federal ministry of Health
HDL	High Density Lipoprotein
IDF	International Diabetes Federation
IHD	Ischemic Heart Disease

DOI: 10.21522/TIJPH.2013.07.02.Art013
ISSN: 2520-3134

LDL	Low-Density-Lipoprotein
LMIC	Low and Middle Income Countries
NCD	Non-communicable Diseases
NGO	Non-Governmental Organization
NIDDM	Non-insulin-dependent diabetes mellitus
NPC	Nigeria population Commission
OR	Odd Ratio
SES	Socio-Economic Status
SMOH	State Ministries of Health
SPSS	Statistical Package for Social Science
US	United States of America
WHO	World Health Organization

Introduction

Globally, Diabetes mellitus (DM) is reckoned a disease of major public health concern. DM is a key risk factor for heart failure, stroke and coronary artery disease. Diabetes is a disease that occurs as a result of high blood glucose due to shortage of insulin in the body and/or a decreased ability of the body to utilize insulin. Insulin is a hormone that helps glucose from food get into the cells and the conversion of glucose to energy of which when its activity is truncated results to damage of vital organs due to excess glucose and fat in the blood. (National Institute of Diabetes and Digestive and Kidney Diseases, 2017). Diabetes is characterized by high blood glucose in addition to problems with the metabolism of protein, carbohydrate and fat due to either absolute or relative lack of insulin hormone (Cook-Huynh, 2012). DM are of many types, the commonest being type 1, type 2, and gestational diabetes. However, the other less common types are monogenic diabetes that is an inherited form of diabetes, as well as cystic fibrosis related diabetes (National Institute of Diabetes and Digestive and Kidney Diseases, 2017). Type-1 diabetes is usually diagnosed in children and young adults but can occur at any age. This accounts for about 5% of diabetes cases. Type-2 diabetes covers about 90 – 95% of all cases and is associated with obesity, older age, family history, and physical inactivity (DAN 2013).

Diabetes mellitus remains one of the most common chronic metabolic disorders globally. The prevalence of DM in adults worldwide was estimated to be 4% in 1995 and is expected to rise to 5.4% by the year 2025 and 7.0% by the year 2050 which is a result of the global increase in obesity besides other associated factors. The majority of this projected numerical increase in cases of DM worldwide is expected to occur in developing countries. With the urban population in developing countries projected to double between year 2000 and year 2030, an estimated 82 million individuals aged 64 years in developing countries and more than 48 million in developed countries will have diabetes. (Cook-Huynh, 2012). However, according to WHO 2017 diabetes report, the number of people with diabetes in the world rose from 108 million in 1980 to 422 million in the year 2014, as well, the global prevalence of diabetes among adults over 18 years rose from 4.7% in 1980 to 8.5% in year 2014. Globally Diabetes associated death in 2015 is estimated at 1.6 million deaths.

While the prevalence of DM is approximately 8% in much of Europe and the United States, and is associated with high morbidity and mortality, the report of the IDF Diabetes Atlas 8th Edition, estimated that in 2017, about 15.5 million adults between the ages of 20 and 79 years were living with diabetes in the IDF Africa Region, representing a regional prevalence of 3.3%. The highest prevalence of diabetes in the Africa Region is found in adults between the ages of 55 and 64 years. Overall in the African region, more than two-thirds (69.2%) of adults currently living with diabetes in the Area are unaware of their condition (about 30.8% awareness level), making it the region with the highest proportion of undiagnosed diabetes. Moreover about 55.3% of adults living with diabetes in the Africa Region, live in the urban areas. Awareness of diabetes varies across populations, regions and studies for instance in India, Muninarayana

et al (2010) reported 50.8% general population awareness while Omobuwa & Alebiosu (2014) reported 75.9% awareness in South west Nigeria.

Nigeria has the largest population in Africa, about 186 million in 2016 (NPC 2016). In Nigeria One third of all the cases of diabetes are in the rural communities, while the rest are in the urban centers. Diabetes Mellitus in Nigeria are largely undiagnosed with more than two million cases (>50%) or more unaware of their diabetic status (DAN 2013). Diabetes Mellitus is a common endocrine-metabolic disorder affecting at least 5 million Nigerians (≈ 2.2% mean national prevalence) and is associated with a high morbidity and mortality. Nigeria currently has the highest burden of diabetes in Africa (DAN 2013). It has been shown in Nigeria that about 96% of cases of diabetes were type 2 Diabetes (DAN 2013). Nevertheless, many cases of type 1 diabetes may die young of acute complications, be misdiagnosed, or may not present to hospital due to poverty and lack of health insurance. Gestational diabetes is increasingly being recognized and diagnosed in Nigeria as most antenatal clinics conduct routine urine analysis test with a follow up OGTT for all patients with glucose in the urine.

In Nigeria, various studies have reported the prevalence of diabetes to vary across different zones of the country of which ranges from 2.2% - 9.8% with much lower prevalence in rural communities (Chinenye and Ogbera, 2013). Sabir et.al (2013) reported a low prevalence of 0.8% among rural population in North West Nigeria, while Isara & Okundia (2015) and Sabir et.al (2017) reported a prevalence of 4.6% in rural Southern Nigeria and 4.3% in rural North West Nigeria respectively. However, higher prevalence of 25% was reported in Urban South East Nigeria by Mezie-Okoye in 2013.

Diabetes mellitus had been projected to increase globally with the majority of the projected increase expected to occur in developing countries according to IDF (2017). With increasing urban lifestyle among our rural populace, there is an expectation that an increase in prevalence of Diabetes is imminent in our rural communities. There is dearth of research studies describing the prevalence and awareness of diabetes in rural communities in North Central Nigeria, moreover, the clinical experience in rural communities of Abuja informed the hypothesis that the prevalence of diabetes mellitus is on the increase in rural communities of Abuja. The above-mentioned situations prompted the conduct of this study.

Objectives

1. To determine the prevalence of diabetes in rural communities in Abuja, FCT Nigeria.
2. To determine the awareness of diabetes in rural communities in Abuja, FCT Nigeria.

Materials and methods

A community-based cross-sectional study on Male and Female adults from age range of 18 years and above residing in Kagini / Tunga Dalhatu communites both in AMAC and Shagari village community in Bwari AC as well as Kaidasabo community in Gwagwalada AC all in Federal Capital Territory (FCT), Abuja Nigeria. Using a four-stage, multi-stage sampling technique 420 participants were recruited for the study. A pre-tested, structured interviewer-administered questionnaire was used to collect information from the participants. The random blood glucose test was done using ACCUCHEK Active blood glucose measuring device. The completed questionnaires were manually sorted out, checked for completeness, coded and analyzed using Statistical Package for Social Science (SPSS, version 20.0, International Business Machines [IBM] Corp, USA.). Data were summarized using frequency tables, percentages, charts, means and standard deviations. The primary outcome variable is Blood Sugar level while the socio-demographic characteristics make up the independent variables. The awareness level was analyzed in percentages and univariate analysis was performed for the primary outcome variable - Blood Sugar level while multivariate analyses were done to ascertain the relationship of the various socio-demographic characteristics to diabetes. Results were considered significant at p-value of less than or equal to 0.05.

DOI: 10.21522/TIJPH.2013.07.02.Art013
ISSN: 2520-3134

Inclusion criteria

Individuals aged 18 years and above in the selected communities who gave consent for participation were included.

Exclusion criteria

Individuals aged 18 years and above in the selected communities who are unable to give response due to serious physical or mental illness and with whom anthropometry measurements were excluded from the study.

2. Individuals below 18 years of age in the selected communities. 3. Pregnant women.

Operational definition

The Diagnosis of Diabetes was made at a casual (Random) Blood glucose of ≥ 200mg/dl (≥11.1 mmol/l) while Pre-Diabetes was diagnosed at a casual (Random) Blood glucose of 140 mg/dl – 199mg/dl (7.8-11.0 mmol/l) DAN (2013).

Ethical consideration

Ethical approval for the study was obtained from The Research and Ethics Committee of Abuja Municipal Area Council Health Department, Federal Capital Territory, Nigeria. Furthermore, informed consent was received accordingly from research participants who volunteered to take part in the study. The research participants were assured of the confidentiality of their information/data.

Limitations of the study

The use of random blood sugar test for the diagnosis of Diabetes Mellitus was a limitation. Fasting blood sugar would have been a better option as it would have been possible to identify those with impaired Glucose Function.

Results and discussions

Results

Socio-Demographic Characteristics of Respondents

Table 1. Age, Gender and Occupation distribution of participants

Age	**Frequency**	**Percentage %**
18-34	189	46.3
35-44	83	20.3
45-54	98	24.0
55-64	28	6.9
65and above	10	2.4
Gender	**Frequency**	**Percentage %**
Male	135	33.1
Female	273	66.9
Occupation	**Frequency**	**Percentage %**
Unskilled	207	50.6
Skilled	134	32.9
Home-maker	28	6.9
Students	39	9.6

Table 2. Geopolitical zone, marital status and education distribution of participants

Variable	Respondents (n)	Percentage (%)
Geopolitical zone		
North Central	181	44.4
North East	11	2.7
North West	35	8.6
South East	104	25.5
South South	44	10.8
South West	33	8.1
Marital status		
Single	62	15.2
Married	330	80.9
Divorced	2	0.5
Widow	14	3.4
Single	62	15.2
Education		
No formal education	45	11.0
Primary education	69	16.9
Secondary education	167	40.9
Tertiary education	127	31.1

Table 1 shows the Age, Gender and Occupation distribution of participants. The study enrolled 408 study participants 135 (33.1%) males and 273 (66.9%) females. The mean age and the standard deviation of the participants were calculated to be 37.86 ± 11.53 (Male: 38.15 ± 12.91; Female: 37.73 ± 10.85). We had approximately 46% participants within age range of 18 to 34 years which was followed by those between the ages of 45 to 54 years (24%), then (20.3%) for age 35-44 years, 6.9% for ages of 55 to 64 years but only 2.4% of them belonged to the age category of 65 years and above. About half (50.6%) of the participants belonged to the unskilled workforce (farmers, traders, artisans, cattle breeders, transporters etc.) followed by skilled workforce 32.9% (public servants, organized private business and clergy. Students represent 9.6% while home makers represent 6.9% of the participants.

Table 2, recorded the Geopolitical zone, marital status and education distribution of participants. The North Central indigenes were nearly half of the log (181 persons; 44.4%) while North East reported the least number of the respondents interviewed (11 persons; 2.7%). On the education category, secondary school leavers, recorded the highest number of participants (127 persons; 40.9%) where as 31.1% of them were reported to have tertiary education, 16.9% had primary education and just 11% had no formal education. Most of the respondents were married (330 persons; 80.9%), however single and widowed recorded 62 (5.2%) and 14 (3.4%) respectively.

DOI: 10.21522/TIJPH.2013.07.02.Art013
ISSN: 2520-3134

Table 3. Prevalence of diabetes in rural communities in abuja

Variable	Respondents (n)	Percentage (%)
RBS CATEGORIES		
Normal range of RBS (60-139Mg/dl)	373	91.4
Pre-diabetes (140-199Mg/dl)	17	4.2
Diabetes (200Mg/dl)	**18**	**4.4**
EVER CHECKED BGL		
Yes	170	41.7
No	238	58.3
WHEN BGL WAS CHECKED		
More than a week	10	2.5
More than a month	63	15.4
More than a year	97	23. 8
Not applicable	238	58.3
WHERE BGL WAS CHECKED		
Private hospital/clinic	89	21.8
Primary healthcare center	5	1.2
At home using personal device	2	0.5
Govt./Gen/specialist hospital	68	16.7
Medical outreach	5	1.2
NGO	1	0.2
Not applicable	238	58.3
*BGL: Blood Glucose Level, RBS: Random Blood Sugar		

The results of our analysis as shown in **table 3** above showed that 373 (91.4%), 17 (4.2%) and 18 (4.4%) were reported for normal range of RBS, pre-diabetes and diabetes among the participants respectively. More than half of the respondents (238; 58.3%) reported that they had checked their blood glucose level, while approximately 42% of them had not done so prior to the time of this study, however, majority of those who had checked it had done this over a year ago (97; 23.8%), while only 10 (2.5%) of them claimed that they checked it less than a month ago. The most common place where people check their blood sugar was in Private hospital/clinic which was reported to be about 22% of them. The general population Diabetes prevalence of **4.4%** is also depicted in figure 1 below.

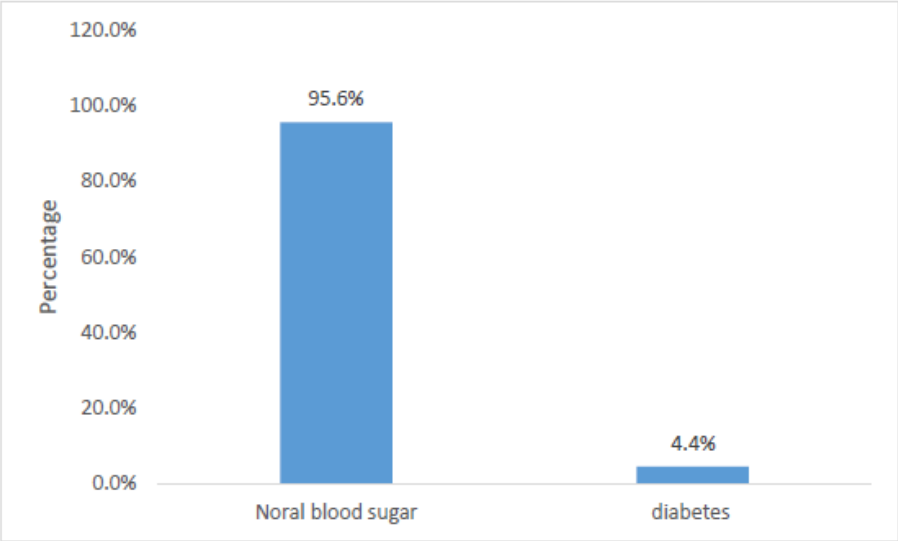

Figure 1. Status of glucose level in percentage/diabetes prevalence

Table 4. Prevailing knowledge of diabetes in rural communities in abuja

Variable	Respondents (n)	Percentage (%)
Ever heard of diabetes		
Yes	339	83.1
No	69	16.9
Ever diagnosed with diabetes		
Yes	16	3.9
No	385	96.1
Source of information about dm		
From My Doctor	209	51.2
Media	44	10.8
Nurse	113	27.7
Friends	2	.5
Non- Response	40	9.8

From table 4 above, over 4/5 of the participants have heard of diabetes (339 person; 83.1%) which a substantial level of awareness while more than half of them (51.5%) reported that the source of the information was from their doctor and 27. 7% from their nurse giving a combined 'healthcare workers' source to be 79.2%. Furthermore, 16 persons; (3.9%) of participants had been diagnosed of DM giving rise to prevalence of 11.1% (2/18) for newly diagnosed diabetes cases among the rural populace who were not previously aware of their diabetes status and also were not on treatment.

DOI: 10.21522/TIJPH.2013.07.02.Art013
ISSN: 2520-3134

Table 5. Multiple logistic regression for the socio-demographic predictors of diabetes in rural communities in abuja

Variable	Odd Ratio	P-value	95% CI for Odd Ratio
Sex			
Male	**Reference**		
Female	3.20	0.020	(1.20 – 8.53)*
Age			
18-34	**Reference**		
35-44	2.25	0.083	(0.90 – 5.64)
45-54	6.02	0.001	(2.45 – 15.02)*
≥ 55	22.79	0.001	(4.79 – 108.40)*
Geopolitical Zone			
North Central	**Reference**		
North East	3.49	0.480	(0.11 – 110.09)
North West	0.66	0.640	(0.12 – 3.77)
South East	0.80	0.590	(0.35 – 1.83)
South South	0.50	0.070	(0.15 – 1.09)
South West	1.03	0.960	(0.32 – 3.3)
Marital Status			
Single	**Reference**		
Married	0.82	0.750	(0.25 – 2.69)
Education			
No formal education	**Reference**		
Primary	0.72	0.690	(0.15 – 3.60)
Secondary	1.32	0.710	(0.30 – 5.80)
Tertiary	1.09	0.910	(0.25 – 4.78)
*Significant at 5% level of significance, CI: Confidence interval			

The study as seen in table 5 above revealed that a statistically significant association exist between diabetes and variables such as: age and sex. But there was no statistically significant association between those reported with diabetes and explanatory variables such as, geopolitical zones, marital status, and educational level. Females are 3 times more likely to have diabetes compared to males as observed in the study (OR=3.20; CI: 1.20:8.53, those within the ages of 45 and 54 years were 6 times more likely to have diabetes compared to those within the ages of 18 and 34 years (OR = 6.02; CI: 2.45 – 15.02), and those belonging to 55 years and above were 23 times at higher risk of having diabetes compared to those aged 18 to 34 years (OR = 22.79; CI: 4.79 – 108.40). The Female sex and increasing age above 44 years were identified significant predictors of DM.

Discussion of findings

Socio – demographic characteristics

The mean age of 37.86 years ± 11.53 standard deviation was reported in this study (Table 1). This is lower than the study by Murthy G. V. S. et.al (2013) which reported a much higher mean age of 55.9 years

± 12.4 standard deviation. Furthermore, the age group between 18 – 34 years had the highest number of participants, while the age group 55 years and above had the least participants which is dissimilar to the findings of Isara and Okundia (2015) which reported age group 55 years and above to be the highest in proportion. The gender distribution revealed that 2/3rd of the participants were female, whereas 1/3rd were male (Table 1). This can be explained by the general out–going nature of the men folk in Nigeria while the women folk tend to be less out going and more of homemakers who were seen in their numbers more than the men in these communities during the study period. This is similar to the findings of Isara and Okundia (2015) in rural communities in Southern Nigeria who also recorded a ratio of one to three. For the occupational status, table 1 recorded that the unskilled workforce who are largely farmers, petty traders, artisans etc made up about 51% of the participants, which is expected in a rural setting in Nigeria as was also recorded in the works of Isara and Okundia (2015). This was followed closely by the skilled workforce (33%) who are mainly public servants which is likely due to the proximity of some of the communities to the Abuja Township, thus, they are playing host to most of public servants who took advantage of the cheap accommodation available in theses rural communities. Table 2 reported that the geopolitical zones of the participants showed that North Central Zone which is the host geopolitical zone where Abuja the study area is located, had the highest number of participants (almost half) which is expected, followed by South East Zone, while the North East Zone had the lowest participants. Furthermore, the married people had the highest participants (4/5th) of the total which agrees with the occupational distribution which recorded only 9.5% for the students' population who are likely to be single (Table 2). The educational status showed that less than 1/3rd of the respondents had tertiary education which again is expected in a rural setting (table 2).

Prevalence of diabetes in rural communities in Abuja, FCT Nigeria

In this study, the prevalence of Diabetes Mellitus in rural communities in Abuja (**defined by random blood sugar of 200 mg/dl or greater**) was 4.4% (Table 2/ figure 1), which is similar to 4.3% found in rural North West Nigeria (Sabir et.al 2017). This prevalence is higher than the National prevalence of 2.2% (DAN 2013). This also is much higher than the work of Sabir et.al (2013) who reported prevalence of less than 1% for diabetes in Nigeria. These statistics had further highlighted the rising trend of diabetes prevalence in Nigeria over the last five decades which supports the hypothesis that the prevalence of diabetes is on the increase in rural communities of Abuja, Nigeria. Additionally, some recent studies in Nigeria had revealed significantly higher prevalence than 4.4% reported in this work such as Makusidi et.al (2013) with 6% prevalence in Sokoto, North west Nigeria and c. Furthermore, this study recorded as seen in table 2 the prevalence for Pre-diabetes in rural communities in Abuja to be 4.2% (**Pre-diabetes defined as random blood sugar of 140-199Mg/dl**) thus highlighting the public health challenge posed by diabetes in these communities.

Prevailing knowledge of diabetes in rural communities of abuja

The study recorded that over 4/5th of the participants had knowledge of diabetes (339 person; 83.1%) with 79.2% reported their information source to be from a healthcare worker (doctors and nurses). This awareness level may be associated with availability of both public and private health facilities in all the communities selected for the study. This is also substantiated by the fact that most of the participants reported healthcare workers as the source of their information. The awareness level recorded in this study is higher than 50.8% reported in India by Muninarayana et al (2010) similar to 75.9% recorded in South West Nigeria by Omobuwa & Alebiosu (2014). Also recorded was the prevalence of 11.1% (2/18) for newly diagnosed diabetes cases among the rural populace who were not previously aware of their diabetes status and also were not on treatment. This however, is lower than 50% of undiagnosed diabetes globally as projected by IDF (2017) and greater than 50% undiagnosed diabetes in Nigeria as estimated by DAN (2013). This may be explained by high level of awareness of Diabetes reported in these communities.

DOI: 10.21522/TIJPH.2013.07.02.Art013
ISSN: 2520-3134

Relationship of socio-demographic characteristics of participants and diabetes

The study revealed that sex and age were significantly associated with DM and that Females were three times more likely to have diabetes compared to males (table 5) which is similar to the findings of Isara and Okundia (2015) in rural Southern Nigeria. This may probably be due to sedentary lifestyle of most married women in these rural communities and associated high incidence of obesity/overweight which are all predisposing factors to developing of diabetes. However, Muninarayana et al (2010) reported the reverse where males were three times at risk of diabetes than females in rural India. Furthermore, in this study, increasing age above 44 years was identified as significant predictor of DM, in line with IDF report that DM is highest in older age group (IDF 2017). Moreover there were no statistically significant association observed between diabetes and geopolitical zones, marital status as well as educational level, conversely, Muninarayana et al (2010) reported a threefold risk of diabetes among literate participants.

Conclusion

This study has highlighted the fact that diabetes is on the increase in the rural communities of Abuja, Nigeria, with reported prevalence that are higher than the National average. There's also an established association between diabetes and female genders as well as increasing age. Thus it is recommended that the FMOH Nigeria/National Council on Health, SMOH, NGOs, Donor Agencies as well as Diabetes societies in Nigeria should work together in dissemination of accurate health education on diabetes, and to institute sound surveillance and control programs for diabetes among rural communities to tame the tide of increasing prevalence of diabetes.

References

[1].Alan J. Garber, Martin J. Abrahamson, Joshua I. Barzilay, Lawrence Blonde, Zachary T. Bloomgarden, Michael A. Bush, Samuel Dagogo-Jack, Michael B. Davidson, Daniel Einhorn, Jeffrey R. Garber, W. Timothy Garvey, George Grunberger, Yehuda Handelsman, Irl B. Hirsch, Paul S. Jellinger, Janet B. McGill, Jeffrey I. Mechanick, Paul D. Rosenblit, Guillermo Umpierrez, and Michael H. Davidson (April 2015). AACE/ACE Comprehensive Diabetes Management Algorithm 2015. *Endocrine Practice*. *21* (4): 438-447. https://doi.org/10.4158/EP15693.CS.

[2].Chinenye S., Ogbera A.O. (2013). Socio-cultural aspects of diabetes mellitus in Nigeria. *Journal of Social Health, Diabetes. 1*(1): 15 – 21.

[3].Cook-Huynah M. (2012). High prevalence of cardiac and extra cardiac target organ damage in refractory hypertension. *Journal of Hypertension*. *19*:2063–2070.

[4].Diabetes Association of Nigeria (DAN), (2013). Clinical Practice Guidelines for Diabetes Management in Nigeria. 2nd ed. Bekdik Printing Press. Port Harcourt, Nigeria. www.diabetesnigeria.org.

[5].Healthline Newsletter (2016). Junk Food and Diabetes. Accessed from www.healthline.com/health/type-2-diabetes/junk-food.

[6].International Diabetes Federation (IDF) Atlas 8th Edition (2017). Accessed from https://diabetesatlas.org.

[7].Isara A. R., Okundia P. O. (2015). The burden of hypertension and diabetes mellitus in rural communities in southern Nigeria. *The Pan African Medical Journal. 20*: (103). Retrieved from http://www.panafrican-med-journal.com/content/article/20/103/ful.

[8].Makusidi M.A., Liman H.M., Yakubu A., Isah M.D., Jega R. M. (2013). Prevalence of non-communicable diseases and its awareness among inhabitants of Sokoto metropolis: outcome of a screening program for hypertension, obesity, diabetes mellitus and overt proteinuria. *Arab Journal of Nephrology Transplant. 6*(3): 189 - 191.

[9].Mallo I.Y. and Obasanya V.G. (2012). Socio-economic effects of Demolishing Squatter Settlements and Illegal Structures in Abuja Metropolis, Federal Capital Territory, Nigeria. Confluence *Journal of Environmental Studies*. ***7.*** Retrieved from http://works.bepress.com/cjes_kogistateuniversity/12/

[10]. Mezie-Okoye (2013). Diabetes in older adults: experience from a rural community in south-east Nigeria. *African Journal of Diabetes Medicine*. *21*(2): 45 - 48.

[11]. Muninarayana C. Balachandra G., Hiremath S. G., Iyengar K., and Anil N. S. (2010). Prevalence and awareness regarding diabetes mellitus in rural Tamaka, Kolar. *International Journal of Diabetes in Developing Countries 30* (1): 18–21. doi: 10.4103/0973-3930.60005.

[12]. Murthy G. V. S. et.al (2013). Prevalence and risk factors for hypertension and association with ethnicity in Nigeria – results from a national survey. *Cardiovascular Journal of Africa. 24* (9) 344-350. doi 10.5830/cvJA 2013.158.

[13]. National Institute of Diabetes and Digestive and Kidney Diseases (2017). Retrieved from www.niddk.nih.gov/health-information/diabetes/overview/what-is-diabetes.

[14]. Nigeria Population (2016). Tradingeconomics.com. accessed from https://tradingeconomics.com/nigeria/population.

[15]. Noble J. A. and Valdes A.M. (2012). Genetics of the HLA Region in the Prediction of Type 1 Diabetes. National Center for Biotechnology Information. Accessed from www.ncbi.nlm.nih.gov/pmc/articles/PMC3233362/doi:10.1007/s11892-011-0223x.

[16]. Omobuwa O & Alebiosu O.C. (2014). Awareness of diabetes amongst undergraduates in a Nigerian University, South West Nigeria. *Sahel Medical Journal.* 17: 29-33.

[17]. Sabir A, Ohwovoriole A, Isezuo S, Fasnmade O, Abubakar S, Iwuala S. (2013). Type 2 diabetes mellitus and its risk factors among rural Fulanis of northern Nigeria. *Annals of African Medicine*; *12*(4): 219 – 22.

[18]. Sabir A. A., Balarae S., Sani A.A., Isezuo S.A., Bello K.S., Jimo S.S. (2017). Prevalence of Diabetes Mellitus and risks factors among the suburban population of Northwest Nigeria. *Sahel Medical Journal*. 20: 168-72.

[19]. World Health Organization (2013). Fact Sheet No 312.

[20]. World Health Organization (2017). Diabetes facts sheet. Accessed from http://www.who.int/news-room/fact-sheets/detail/diabetes.