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PUBLIC HEALTH | RESEARCH ARTICLE

Prevalence of diabetes and pre-diabetes in Oke-Ogun region of Oyo State, Nigeria

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Abstract: *Background*: Oke-Ogun consists of 10 out of the 33 Local governments in Oyo State, Nigeria. Although literature abounds on prevalence of diabetes in Nigeria, there is none in this geo-political zone, despite the fact that there is a high genetic and socio-cultural factors predisposition the residents to diabetes and pre-diabetes. *Objectives*: The purpose of the study was to assess the prevalence of diabetes and pre-diabetes and associated socio-demographic characteristics among indigenes of Oke-Ogun. *Method*: Of the 10,000 respondents who participated in the study, 6,915 had completed data. Fasting Plasma Glucose (FPG) was measured using calibrated glucometers and classified thus; normal (≤6 mmol/l), pre-diabetes (6.1–6.9 mmol/l), and diabetes (≥7 mmol/l). Data were analyzed using descriptive statistics, chi-square and binary logistic regression tests at value of $p < 0.05$. *Results*: There was a female preponderance for diabetes and pre-diabetes. Majority, 63.4% had no formal education, 82.9% earned less than NGN18,000 ($50) per monthly income. The mean FPG was 5.50 ± 2.20 mmol/l. The overall prevalence of diabetes and pre-diabetes in the study were 4.6 and 6.0% respectively. *Conclusion*: This study shows high prevalence of diabetes and pre-diabetes among residents of Oke-Ogun. DM is more

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Shittu O. Rasaki was born to the prestigious family of Aganmu and Arowoselu, Saki; Oyo state, Nigeria. He attended University of Ilorin, Nigeria for his first degree, where he bagged Bachelor of Medicine, Bachelor of Surgery (MBBS). He later proceeded to the Post-Graduate School in the same Institution for his Master's degree in Public Health (MPH). He had first class in Post-Graduate Diploma in Education (PGDE) from National Open University of Nigeria. He is a Fellow of the West African College of Physician (FWACP), Family Medicine. He is currently the Hospital Consultant to the Ilorin Teaching Hospital, Ilorin, Kwara state, Nigeria. He is also the Chief Medical Director of Oorelope Hospital (Consultant Specialist Clinics) and National Health Insurance scheme (NHIS) accredited healthcare center at Apata Yakuba, Ilorin, Kwara state, Nigeria. His area of interest is Family Medicine and Infectious Disease.

PUBLIC INTEREST STATEMENT

Diabetes is the presence of excess sugar in the blood due to insulin hormone deficiency and/or destruction of the receptor sites. There are two types of diabetes. Type 1 diabetes results from a cellular mediated autoimmune destruction of the β-cell of the pancreas. Type 2 encompasses individual who have insulin resistance and usually have relative (rather than absolute) insulin deficiency. A fasting plasma glucose level >126 mg/dl (7.0 mmol/l) or a casual plasma glucose >200 mg/dl (11.1 mmol/l) meets the threshold for the diagnosis of diabetes. Symptoms of diabetes include; passage of excessive urine (polyuria), excessive thirst (polydipsia), excessive food intake (polyphagia) yet associated weight lost, excessive itching of the body (pruritus), skin diseases (diabetes dermatopathy), decrease libido or Erectile Dysfunction in Male. Vagina itching (pruritus vulva), recurrent abortion or intrauterine fetal death in Female. It damages the eyes (blindness), kidneys (kidney failure), heart and blood vessels (atherosclerosis, hypertension, stroke), It impairs growth and susceptibility to infections. It is advisable to check our blood sugar regularly.

common in the females, and in those below the age of 61 years. The high pre-diabetes prevalence might imply an impending diabetes epidemic among the indigene of Oke-Ogun. Family history of diabetes, a surrogate of genetics is an important association of DM in the study. A large proportion of the residents were in abject poverty, a critical factor to be considered in their management.

Subjects: Health & Society; Health Conditions; Medicine

Keywords: prevalence; diabetes and pre-diabetes; Oke-Ogun; Oyo State; Nigeria

1. Introduction

Diabetes mellitus is chronic non-communicable disease associated with long term complications to the brain, kidney, and the heart. There is destruction and loss of the ß-cells of the pancreas causing insulin deficiency; it may also result from abnormalities arising from resistance to insulin. Symptoms of hyperglycemia include polydipsia, polyphagia polyuria, blurred vision, weight loss, generalized pruritus, neuropathy, retinopathy, etc. Life threatening consequences of uncontrolled diabetes include diabetes-ketoacidosis, lactic acidosis and hyper-osmolar non-ketotic state (Diabetes Care, 2006).

Diabetes is preceded by impaired fasting glucose (IFG) resulting in a pre-diabetic state which can exist undetected for many years, (Nathan et al., 2007) causing irreversible damage to vital organs. Pre-diabetes is a practical term referring to Impaired Fasting Glucose (IFG), impaired glucose tolerance (Ronald & Zubin, 2013) or a glycosylated hemoglobin (A1c) of 6.0 to 6.4%, each of which places individuals at high risk of developing diabetes and it complications. The World Health Organization criteria for diagnosing pre-diabetes are fasting plasma glucose level of between 6.1 and 6.9 mmol/l. A fasting plasma glucose level 7.0 mmol/l or more meets the criteria for the diagnosis of diabetes. Fasting value for venous and capillary plasma glucose are identical (World Health Organization, 1999).

There is an increasing prevalence of diabetes and pre-diabetes worldwide (International Diabetes Federation, 2006). Over 5 million people suffer from the disease in Africa and the number is expected to skyrocket to 15 million by 2025 (International Diabetes Federation, 2006). In Nigeria the prevalence varies from 0.65% in rural Mangu village to 11.0% in urban Lagos (Akinkugbe, 1997). With the incidence of diabetes in Africa, diabetic complications are also expected to rise proportionately (Wild et al., 2004; Zimmet, 2003). This will undoubtedly pose serious health and economic problems. The disease affects many people under the age of 64 years in Africa as compared to the developed world where it affects many people over the age of 64 years (Wild et al., 2004). In Nigeria the National prevalence of diabetes was 2.2% (Akinkugbe, 1997). In South Eastern Nigeria the overall prevalence of diabetes was 10.51% (Chris et al., 2012), whereas in South Western Nigeria the prevalence of diabetes ranges from 4.76% in Ile-Ife, Osun State to 11.0% in Lagos (Akinkugbe, 1997; International Diabetes Federation, 2006). Also 0.8% of diabetes mellitus, and 2.2% of Impaired Glucose Intolerance in Ibadan (Olatunbosun et al., 1998). This was comparable to who reported a prevalence of 2.8% in Ibadan (Owoaje et al., 1997), 1.7% in Ilorin (Erasmus et al., 1989; Ohwovoriole et al., 1988), and 6.8% in Port Harcourt, Nigeria (Nyenwe et al., 2003). In 2004, a survey in Jos (Nyenwe et al., 2003) reported a prevalence of 10.3%. Nyewe et al. (2003) reported a prevalence of 2.2% in Port Harcourt in 2003. A prevalence of 4.7% was reported by Lucia and Prisca (2012) which was higher than the national prevalence of 2.2% reported in the International Diabetes Federation in 2007 (International Diabetes Foundation, 2007). A review of studies on the prevalence of diabetes in adults in Africa by Unwin, Sobugwi, and Alberti (2001) and Azevedo and Alla (2008) demonstrated a rising prevalence across the continent. However, the prevalence of diabetes in Tanzania was 0.9% (McLarty et al., 1974). This notable difference in the number of people with diabetes is an indication of the increase in the trend of diabetes in developing countries (International Diabetes Foundation, 2011).

In Nigeria, as a result of abject poverty and lack of adequate access to health care, many cases of diabetes are undiagnosed, following closely the rule of Halves (Hart, 1992) which states that: half of the people living with diabetes have been diagnosed, half of those diagnosed received professional

care and of those receiving care, only half achieve their treatment goals. Of those achieving treatment targets, half are free from diabetes complications.

Oke-Ogun geo-political zone of Oyo State has a dietary and socio-cultural identity. They are known to consume a lot of carbohydrate/cassava diet and this along with their genetic predisposition; makes them prone to having diabetes mellitus. There is no record of prevalence of DM and pre-diabetes in the area, even though, the disease is common among the people.

This study aimed at accessing the prevalence of diabetes and pre-diabetes and associated risk factors among the residents of Oke-Ogun geopolitical zone of Oyo State, Nigeria. It is not about current treatment or intervention rather it draws the attention to the high prevalence level of DM and Pre-Diabetes in Oke-Ogun Area of Oyo State.

2. Methodology

Oke-Ogun consists of 10 Local Governments (LG) out of the present 33 in Oyo state. It has a population of about 1.8 million, according to the 1996 census conducted in Nigeria. Oyo state has the largest landmass in the South West geo-graphical zone of Nigeria; sixty percent (60%) of the landmass is the Oke-Ogun area of about 13,537 km^2 which is larger than the landmass of 29 out of the 36 states in the present Federation of Nigeria. There is disparity in socio-economic development as reflected by the lack of adequate health facilities, economic investment and educational facilities. The consequence of all these is the pervading low quality of life of people in the area.

This study took place from 4 March to 6 May 2016 on every Friday and Saturday; beginning from 8 to 10am at a designated Health Centre in the respective LG. The FPG was done on site after the participants fasted. Permission was taken from the Oyo State Ministry of Health, the Local Government Chairman and the Supervisory Councilor for Health. Consent was sought from the participant. Participation was voluntary and uncoerced. The purpose of the study and details of the tests were explained to the respondents and informed consent was obtained.

Sample size of 10,000 was used using the Lesley Kish (Fisher et al., 1998) statistical formula. There are three strata involving local government, wards and participants. There are 10 Local Governments in Oke-Ogun and the respective wards are Atisbo (10 wards), Iseyin (11 wards), Irepo (10 wards), Iwajowa (10 wards), Itesiwaju (10 wards), Kajola (11 wards) Olorunsogo (10 wards), Orelope (10 wards), Saki East (11 wards) and Saki West (11 wards). The first stage involved using the mechanical balloting system, names of the wards in each LG was printed and placed in a container. It was properly mixed. With eyes close, the first 5 wards were pulled out. A total of 50 wards were selected. The second stage involved selection of 200 respondents in each of the wards. 40 respondents were selected each on Friday and Saturday using simple random technique, until a total of 1,000 in each LG and 10,000 for the overall Oke-Ogun areas was obtained.

A structured questionnaire designed to obtain information regarding age, sex marital status, level of education, family history of diabetes and salary scale was administered to the participants by trained assistants. Easymax blood glucose monitors with Serial Numbers (Q91A010211, Q91A010213, Q91A010220) were used. It is relatively cheap equipment, sensitive and specific for developing countries. Fasting Plasma Glucose was preferred because of its convenience in a clinical setting and low cost. The patients were asked not to take any food from 8am until the sample was collected. The WHO criteria for diabetes were used. The FPG of the respondents was classified as normal (≤6.0 mmol/l), pre-diabetes (6.1–6.9 mmol/l), diabetes (≥7.0 mmol/l) (Ekpenyong et al., 2012). The WHO criteria was preferred, because it took into account the following guidelines:

- A population perspective, not primarily an individual perspective.
- Scientific integrity with evidence on efficacy.
- Feasibility.

- Cost-effectiveness and opportunity costs.
- Sensitivity to local contexts.
- Transparency.
- A primary audience of health policy makers.

The data was analyzed using the Statistical Packages for Social Sciences (SPSS) version 20 statistical software (SPSS Inc. Chicago, Illinois, USA). Continuous variables, means and standard deviations were calculated and the means compared using the independent samples t test. Pearson Chi-Square test was used to determine the relationship between fasting plasma glucose and socio-demographic factors. Values of $p < 0.05$ were considered statistically significant.

3. Results

The demographic characteristic of respondents is shown in Table 1. There was female preponderance. Majority 63.4% had no formal education, 63.2% were married. They were mainly self-employed 59.0%. Majority (82.9%) of the participants earned less than NGN18,000 ($50) per month.

Table 1. Socio-demographic characteristics of the respondents (*N* = 6,915)

Variables	Frequency	%
Age groups		
18–35 years	2,415	34.9
36–60 years	4,212	60.9
61 years and above	288	4.2
Mean ± SD	55.19 ± 15.70	
Sex		
Male	3,417	49.4
Female	3,498	50.6
Educational level		
No formal education	4,383	63.4
Primary	1,518	22.0
Secondary	721	10.4
Tertiary	293	4.2
Religion		
Christian	2,190	31.7
Muslim	4,712	68.1
Traditional	13	0.2
Marital status		
Married	5,750	83.2
Single	566	8.2
Widows/widowers	599	8.7
Occupation		
Unemployed	501	7.2
Civil servant	904	13.1
Self-employed/Trader	4,077	59.0
Students	1,084	15.6
Farmer	349	5.1
Income NGN ($)		
<18,000 ($50)	5,735	82.9
18,000–45,000 ($50–$130)	968	14.0
>45,000 (>$130)	212	3.1

The relationship between the socio-demographic characteristic and fasting plasma glucose is shown in Table 2. The mean fasting plasma glucose was higher 5.76 ± 2.33 in those above 61 years, among the females, 5.63 ± 2.88 and males 5.47 ± 2.80 and among those with secondary 6.00 ± 2.28 and tertiary 6.01 ± 3.80 education respectively. FPG was also noticed to be higher among the married (6.13 ± 2.57), self employed (6.24 ± 2.13) and those with low income (6.06 ± 2.93). This was statistically significant.

The association between socio-demographic factors and fasting plasma glucose is shown in Table 3. There was a female preponderance of diabetes 295(93.7%) and pre-diabetes 356(85.0%) respectively. Respondents with diabetes 188(59.7%) and pre-diabetes 357(85.2) were common among those between age 36 and 60 years, among those with tertiary education 162(51.4%), 149 (34.6%), the married 182(57.8%) and 207(49.4%).

The association between glycemic level and family history of diabetes is shown in Table 4, eighty-one (22.6%) of the respondents with diabetes had a family history of diabetes. This is statistically significant.

Table 2. Socio-demographic characteristics and glycemic level of respondents

Variables	FPG Mean ± SD	*F*	*p*-value
Age groups			
18–35 years	5.43 ± 2.36	3.31	0.04
36–60 years	5.60 ± 3.11		
61 years and above	5.76 ± 2.33		
Male	5.47 ± 2.80	5.48	0.02
Female	5.63 ± 2.88		
No formal education	5.45 ± 2.65	10.57	<0.01
Primary	5.53 ± 3.33		
Secondary	6.00 ± 2.28		
Tertiary	6.01 ± 3.80		
Marital status			
Married	6.13 ± 2.57	16.39	<0.01
Single	5.75 ± 3.08		
Widows	5.47 ± 2.84		
Occupation			
Unemployed	5.60 ± 2.84	5.28	<0.01
Civil servant	5.52 ± 2.24		
Trade	5.46 ± 2.83		
Self-employed	6.24 ± 2.13		
Students	5.69 ± 4.31		
Farmer	5.41 ± 2.69		
Retired	5.98 ± 2.54		
Income NGN ($)			
<18,000 ($50)	6.06 ± 2.93	18.21	<0.01
18,000–45,000 ($50–$130)	5.46 ± 2.85		
>45,000 (>$130)	5.47 ± 1.89		
Total	5.55 ± 2.84		

Table 3. Association between socio-demographic factors and glycemic level (*N* = 6,915)

Variables	Glycemic level				χ^2	*p*-value
	Normal	Pre-diabetes	Diabetes	Total		
	n = 6,181	*n* = 419	*n* = 315			
Age group						
18–35 years	2,415 (39.1)	0 (0)	0 (0)	2,415 (100)	1.53	<0.01
36–60 years	3,667 (59.3)	357 (85.2)	188 (59.7)	4,212 (100)		
>60 years	99 (1.6)	62 (14.8)	127 (40.3)	288 (100)		
Sex						
Male	3,334 (53.9)	63 (15.0)	20 (6.3)	3,417 (100)	4.83	<0.01
Female	2,847 (46.1)	356 (85.0)	295 (93.7)	3,498 (100)		
Education						
No formal education	4,270 (69.1)	74 (17.7)	20 (6.3)	4,383 (100)	3.20	<0.01
Primary	1,253 (20.3)	103 (24.6)	19 (6.0)	1,518 (100)		
Secondary	553 (8.9)	93 (22.2)	114 (36.2)	721 (100)		
Tertiary	105 (1.7)	149 (35.6)	162 (51.4)	293 (100)		
Marital status						
Married	5,361 (86.7)	207 (49.4)	182 (57.8)	5,750 (100)	1.25	<0.01
Single	538 (8.7)	28 (6.7)	0 (0)	566 (100)		
Widows	282 (4.6)	184 (43.9)	133 (42.2)	599 (100)		
Occupation						
Unemployed	1,049 (17.0)	31 (7.4)	4 (1.3)	1,084 (100)	3.69	<0.01
Civil servant	875 (14.2)	22 (5.3)	7 (2.2)	904 (100)		
Self-employed	3,602 (58.3)	260 (62.1)	215 (68.3)	4,077 (100)		
Students	393 (6.4)	35 (8.4)	73 (23.3)	501 (100)		
Farmer	262 (4.2)	71 (16.9)	16 (5.1)	349 (100)		
Income (NGN) ($)						
<18,000 ($50)	5,326 (86.2)	212 (50.6)	197 (62.5)	5,735 (100)	6.08	<0.01
18,000–45,000 ($50–$130)	735 (11.9)	171 (40.8)	62 (19.7)	968 (100)		
>45,000 (>$130)	120 (1.9)	36 (8.6)	56 (17.8)	212 (100)		

Table 4. Association between glycemic level and family history of diabetes

FPG	Family history of diabetes		χ^2	*p*-value
	No	Yes		
≤6 (Normal)	5,980 (91.2)	201 (56.1)	460.70	<0.01
6.1–6.9 (Pre-diabetes)	343 (5.2)	76 (21.2)		
≥7 (Diabetes)	234 (3.6)	81 (22.6)		
Total	6,557 (100)	358 (100)		

4. Discussion

This study assessed the prevalence of diabetes and pre-diabetes and associated risk factors among indigenes of Oke-Ogun geo-political zone of Oyo State.

The prevalence of diabetes in this study was 4.6% (93.7% female, 6.3% male) and pre-diabetes 6.0% (85.0% female and 15.0% male). The female constitute the larger part of the study. The male usually don't pay much attention to their health and are always pre-occupied with other things. Usually they will not come out for most of the studies done. This is comparable to 4.7% reported by Nyenwe et al. (2003), Sonny and Ekene (2011) and in India prevalence of diabetes and pre-diabetes was higher in woman compared to men (Anjana et al., 2011; Balagopal et al., 2008; Muthunaryanan et al., 2015).

The prevalence was higher than 0.6% reported by Chinenye et al. (2012) in Port-Harcourt , 0.8% by Olatunbosun et al. (1998) in Ibadan, 1.43% by Erasmus et al. (1989) in Ilorin, 1.5% by Ohwovoriole et al. (1988) in Lagos, 2.2% in Port-Harcourt by Nyewen et al. (2003) and 2.8% by Owoaje et al. (1997) in Ibadan. The prevalence was also higher than 2.2% reported by the Nigerian National Diabetes. In Tanzania, the prevalence reported by McLarty et al. (1974) was 0.9%. Osuntokun et al. (1971) reported a prevalence of 0.4% in a hospital based study. The fact that, this study was not an hospital based study may explain the difference in the prevalence compared with various other studies. Though Akinkugbe and Ojo (1969) study was a community based study, their diagnosis also included presence of glycosuria. Similarly, Johnson (1969) used urinalysis as the method of detection and diagnosis of diabetes mellitus. In the Erasmus et al. (1989) study in Ilorin, there was selection bias and the diagnosis of diabetes was based on the WHO 1980 criteria. Owovoriole et al. (1988) in Lagos measured random blood sugar levels in respondents who received an invitation for the screening.

The prevalence of diabetes in this study was lower than 6.5% reported by Enang et al. (2014), 7.2% reported by the National Non-communicable Disease Survey (Akinkugbe, 1997), 10.51% reported by Chris et al. (2012) in South Eastern Nigeria, 11.0% in urban Lagos (Akinkugbe, 1997; International Diabetes Federation, 2006) and 10.3% in Jos (International Diabetes Federation, 2006).

The study was at variant with Teuscher, Rosman, Baillod, and Teuscher (1987) who noticed an extremely low prevalence of diabetes in a West African rural population using random blood sugar measurement, the prevalence of diabetes in Oke-Ogun—a rural population is high.

In this study, the prevalence of pre-diabetes was 6%. This was higher than the 2.2% obtained by McLarty et al. (1974); a pointer to an impending diabetes epidemic, if no appropriate intervention programme is instituted.

Age and sex were identified risk factors for diabetes mellitus in this study. There was a female preponderance. The male to female ratio of 1:1.1 is similar to that of Ekpenyong et al. (2012), Akinkugbe (1997), and Chinenye et al. (2012). It also reflects the pattern observed in the study by Okoro, Adejumo, and Oyejola (2002) and Chen et al. (2005). Chukwunonso, Nnamdi, and Stella (2015) also reported a higher prevalence in females than males. This finding was also similar to that of Oyegbade, Abioye-Kuteyi, Kolawole, Ezeoma, and Bello (2007) who reported female to male ratio of 1.7:1. The Nigerian National Non-communicable Disease survey and other studies (Elmahdi et al., 1991; Expert Committee on Non-communicable Disease, 1997) made similar observations. The combined effect of elderly women than men in most population is the most likely reason for this observation. This however is in contrasts with the report of Amoah, Owusu, and Adjei (2002), who observed a slightly higher preponderance among males than females. The worldwide diabetes prevalence is similar in men and women, but it is slightly higher in men greater than 60 years of age and women of older ages (King et al., 1998). Generally, prevalence and complication of diabetes are more pronounced in females than males as a result of gender associated adiposity (World Health Organization, 2000).

Our findings of diabetes in those below 60 years are consistent with those of Muthunaryanan et al. (2015) and Enang et al. (2014). In developed countries, diabetes is usually seen in those older than 60 years. In Europe for example, the prevalence of diabetes was less than 10% in people younger than 60 and it was 10 to 20% in people aged 60 to 80 years (DECODE-Study-Group, 2003). According to Guariguata et al. (2014) people with diabetes in developed countries are predominantly over the age of 50 (74%) while those in developing countries are mostly under the age of 50 (59%). Johnson (1969) and McLarty et al. (1974) found that the peak incidence of diabetes in Nigeria and Tanzania was 45 – 59 years of age. The prevalence of diabetes increases with age. In Nigeria for example, the risk of developing diabetes increases 3–4 folds after the age of 44 years. This is attributable to state of healthcare.

The result shows that the people are in abject poverty, earning less than $50 per month to take care of their extended family in a polygamous setting. This implies a lack of adequate resources to most of the respondents and therefore an important factor to be considered in their management.

Eighty-one (22.6%) of the diabetics had a family history of diabetes. This was similar to the 36.4% who had a family history of diabetes as reported by Uloma, Maurice, and Godswill (2015) while accessing the risk of developing diabetes mellitus among local government employees in Onitsha, South-eastern Nigeria. Positive family of history of diabetes and pre-diabetes is the genetic factor responsible for the high prevalence. The environmental factors also contributed to the high prevalence. This includes high refined carbohydrate diet. The abject poverty did not allow the people to go for regular medical check up.

5. Conclusion

The study recorded a relatively high prevalence of DM and pre-diabetes in people of low socio-economic background with family history of diabetes as a predisposing factor. There is need to enlighten the people about diabetes and it attendant complications.

6. Limitations and strength

Blood samples were collected by pricking the finger using one touch glucometer. Venous blood glucose would have been better. However, it has been documented that fasting value for venous and capillary plasma glucose are identical. A more precise measurement would have been glycosylated hemoglobin (A1c), but this is more expensive especially for a large population.

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Competing Interests
The authors declare no competing interest.

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References

Akinkugbe, O. O. (Ed.). (1997). *Final report of national survey on non communicable diseases in Nigeria series 1*. Lagos: Federal Ministry of Health and Social Services.

Akinkugbe, O. O., & Ojo, O. A. (1969). Arterial pressures in rural and urban populations in Nigeria. *BMJ, 2*, 222–224. https://doi.org/10.1136/bmj.2.5651.222

Amoah, A. G., Owusu, S. K., & Adjei, S. (2002). Diabetes in Ghana: A community based prevalence study in Greater Accra. *Diabetes Research and Clinical Practice, 56*, 85–95.

Anjana, R. M., Pradeepa, R., Deepa, M., Datta, M., Sudha, V., Unnikrishnan, R., … Mohan, V. (2011). Prevalence of diabetes and prediabetes (impaired fasting glucose and/or impaired glucose tolerance) in urban and rural India: Phase I results of the Indian Council of Medical Research–INdia DIABetes (ICMR–INDIAB) study. *Diabetologia, 54*, 3022–3027. https://doi.org/10.1007/s00125-011-2291-5

Azevedo, M., & Alla, S. (2008). Diabetes in Sub-Saharan Africa: Kenya, Mali, Mozambique, Nigeria, South Africa and Zambia. *International Journal of Diabetes in Developing Countries, 28*, 101–108. https://doi.org/10.4103/0973-3930.45268

Balagopal, P., Kamalamma, N., Patel, T. G., & Misra, R. (2008). A community-based diabetes prevention and management education program in a rural village in India. *Diabetes Care, 31*, 1097–1104. https://doi.org/10.2337/dc07-1680

Chen, Y., Kittles, R., Zhou, J., Chen, G., Adeyemo, A., Panguluri, R. K., … Rotimi, C. N. (2005). Calpain—10 gene polymorphisms and type 2 diabetes in West Africans: The African American diabetes mellitus (AADM) study. *Annals of Epidemiology, 15*, 153–159.

Chinenye, S., Uloko, A. E., Ogbera, A. O., Ofoegbu, E. N., Fasanmade, O. A., Fasanmade, A. A., & Ogbu, O. O. (2012). Profile of Nigerians with diabetes mellitus - Diabcare Nigeria study group (2008): Results of a multicenter study. *Indian Journal of Endocrinology and Metabolism, 16*, 558–564. https://doi.org/10.4103/2230-8210.98011

Chris, E. E., Akpan, U. P., John, O. I., & Daniel, E. N. (2012). Gender and age specific prevalence and associated risk factors of Type 2 Diabetes Mellitus in Uyo metropolis, South Eastern Nigeria. *Diabetological Croatica, 41*, 17–28.

Chukwunonso, E. C. C. E., Nnamdi, K. U., & Stella, O. N. (2015). Diabetes and pre-diabetes in adult Nigerians: Prevalence, and correlations of blood glucose concentrations with measures of obesity. *African Journal of Biochemistry Research, 9*, 55–60. https://doi.org/10.5897/AJBR

DECODE-Study-Group. (2003). Age and sex-specific prevalence of diabetes and impaired glucose regulation in 13 European cohorts. *Diabetes Care, 26*, 61–69.

Diabetes Care. (2006). 29, S43–S48. Retrieved from Carediabetesjournals.org

Ekpenyong, C. E., Akpan, U. P., Ibu, J. O., & Nyebuk, D. E. (2012). Gender and Age Specific Prevalence and Associated Risk Factors of Type 2 Diabetes Mellitus in Uyo Metropolis, South Eastern Nigeria. *Diabetologia Croatica, 16*, 41–42.

Elmahdi, E. M., Kaballo, A. M., & Mukhtar, E. A. (1991). Features of non-insulin dependent diabetes mellitus (NIDDM) in the Sudan. *Diabetes Research and Clinical Practice, 11*, 59–63. https://doi.org/10.1016/0168-8227(91)90142-Z

Enang, O. E., Out, A. A., Essien, O. E., Okpara, H., Fasanmade, O. A., Ohwovoriole, A. E., & Searle, J. (2014). Prevalence of dysglycemia in Calabar: A cross-sectional observational study among residents of Calabar, Nigeria. *BMJ Open Diabetes Research & Care, 2*, e000032.

Erasmus, R. T., Fakeye, T., Olukoga, O., Okesina, A. B., Ebomoyi, E., Adeleye, M., & Arije, A. (1989). Prevalence of diabetes mellitus in a Nigerian population. *Transactions of the Royal Society of Tropical Medicine and Hygiene, 83*, 417–418. https://doi.org/10.1016/0035-9203(89)90524-5

Expert Committee on Non-communicable Disease. (1997). *Non-communicable disease in Nigeria*. Final Report of a National Survey.

Fisher, A. A., Laing, J. E., Stoeckel, J. E., & Townsend, J. W. (1998). *Handbook for family planning operation research design* (2nd ed., pp. 43–45). New York, NY: Population Council.

Guariguata, L., Whiting, D. R., Hambleton, I., Geagley, J., Linnenkamp, U., Shaw, J. E. (2014). Global estimates of diabetes prevalence for 2013 and projections for 2035. *Diabetes Research and Clinical Practice, 103*, 137–149.

Hart, J. T. (1992). Rule of halves: Implications of increasing diagnosis and reducing dropout for future workload and prescribing cost in primary care. *British Journal of General Practice, 42*, 116–119.

International Diabetes Federation. (2006). *The improved diabetes atlas* (3rd ed). Brussel: Author.

International Diabetes Foundation. (2007). *Diabetes atlas* (3rd ed.). Brussel: Author.

International Diabetes Foundation. (2011). *IDF diabetes atlas*. Melbourne: IDI Heart and Diabetes Institute.

Johnson, T. O. (1969). *Diabetes mellitus in Lagos (Nigeria): A study of the prevalence of the disorder in an African Urban Community* (Thesis). University of London, London.

King, H., Aubert, R. E., & Herman, W. H. (1998). Global Burden of Diabetes, 1995-2025: Prevalence, numerical estimates, and projections. *Diabetes Care, 21*, 1414–1431. https://doi.org/10.2337/diacare.21.9.1414

Lucia, Y. O., & Prisca, O. A. (2012). Type 2 diabetes mellitus and impaired fasting plasma glucose in Urban South Western Nigeria. *International Journal of Diabetes and Metabolism, 21*, 9–12.

McLarty, D. G., Swai, A. B. M., Kitange, H. M., Masuki, G., & MtiRose, G. (1974). Cardio-respiratory disease and diabetes among middleaged male civil servants; a study of screening and intervention. *Lancet, 303*, 469–473.

Muthunaryanan, L., Ramraj, B., & Russel, J. K. (2015). Prevalence of prediabetes and its associated risk factors among rural adults in Tamil Nadu.. *Archives of Medicine and Health Sciences, 3*, 178.

Nathan, D. M., Davidson, M. B., DeFronzo, R. A., Heine, R. J., Henry, R. R., Pratley, R., & Zinman, B. (2007). Impaired fasting glucose and impaired glucose tolerance: Implications for care. *Diabetes Care, 30*, 753–759. https://doi.org/10.2337/dc07-9920

Nyenwe, E. A., Odia, O. J., Ihekwaba, A. E., Ojule, A., & Babatunde, S. (2003). Type 2 diabetes in adult Nigerians: A study of its prevalence and risk factors in Port Harcourt, Nigeria. *Diabetes Research and Clinical Practice, 62*, 177–185. https://doi.org/10.1016/j.diabres.2003.07.002

Ohwovoriole, A. E., Kuti, J. A., & Kabiawu, S. I. O. (1988). Casual blood glucose levels and prevalence of undiscovered diabetes mellitus in Lagos Metropolis Nigerians. *Diabetes Research and Clinical Practice, 4*, 153–158. https://doi.org/10.1016/S0168-8227(88)80010-X

Okoro, E. O., Adejumo, A. O., & Oyejola, B. A. (2002). Diabetic care in Nigeria: Report of a self-audit. *Journal of Diabetes and its Complications, 16*, 159–164. https://doi.org/10.1016/S1056-8727(01)00145-3

Olatunbosun, S. T., Ojo, P. O., Fineberg, N. S., & Bella, A. F. (1998). Prevalence of diabetes mellitus and impaired glucose tolerance in a group of urban adults in Nigeria. *Journal of the National Medical Association, 90*, 293–301.

Osuntokun, B. O., Akinkugbe, F. M., Francis, T. I., Redy, S., Osutokun, O., & Taylo, G. O. I. (1971). Diabetes mellitus in Nigeria: A study of 832 patients. *West African Medical Journal, 20*, 295–312.

Owoaje, E. E., Rotimi, C. N., Kaufman, J. S., Tracy, J., & Cooper, R. S. (1997). Prevalence of adult diabetes in Ibadan, Nigeria. *East African Medical Journal, 74*, 299–302.

Oyegbade, O. O., Abioye-Kuteyi, E. A., Kolawole, B. A., Ezeoma, I. T., & Bello, I. S. (2007). Screening for diabetes mellitus in a Nigerian family practice population. *South African Family Practice, 49*, 15–15d. https://doi.org/10.1080/20786204.2007.10873612

Ronald, G., & Zubin, P. (2013). Definition, classification and diagnosis of diabetes, pre-diabetes and metabolic syndrome. *CDA Clinical Practice Guidelines Expert Committee, 37*, S8–S11.

Sonny, C., & Ekene, Y. (2011). State of diabetes care in Nigeria: A review. *The Nigerian Health Journal, 11*, 101–106.

Teuscher, T., Rosman, J. B., Baillod, P., & Teuscher, A. (1987). Absence of diabetes in a rural West African population with a high carbohydrate/cassava diet. *The Lancet, 329*, 765–768. https://doi.org/10.1016/S0140-6736(87)92797-8

Uloma, A., Maurice, C. A., & Godswill, A. N. (2015). Assessment of risk of developing diabetes mellitus among local government employees in Onitsha, South-Eastern Nigeria. *Epidemiology Report, 3*, 105–106.

Unwin, N., Sobugwi, E., & Alberti, K. G. M. M. (2001). Type 2 diabetes: The challenge of preventing a global epidemic. *Diabetes International, 11*, 4–8.

Wild, S., Roglic, G., Green, A., Sicree, R., & King, H. (2004). Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030. *Diabetes Care, 27*, 1047–1053. https://doi.org/10.2337/diacare.27.5.1047

World Health Organization. (1999). *Definition, diagnosis and classification of diabetes mellitus and it complications: Report of a WHO Consultation. Part 1*. Retrieved May 29, 2007 http://apps.who.int/iris/bitstream/10665/66040/1/WHO_NCD_NCS_99.2.pdf.

World Health Organization. (2000). *Obesity preventing and managing the global epidemic* (pp. 786–777). Geneva: Author. Retrieved from http://whqlibdoc.who.int/trs/WHO_TRS_894.pdf

Zimmet, P. (2003). The burden of type 2 diabetes: Are we doing enough? *Diabetes & Metabolism, 29*, 659–681.

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