Prevalence of pre-diabetes and undiagnosed diabetes mellitus among adults in the Warri Metropolis, Nigeria

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ABSTRACT

Objectives: Diabetes mellitus, a disorder of multiple etiologies is characterised by chronic hyperglycemia and is usually preceded by pre diabetes a condition of impaired fasting glucose (IFG) which places individuals at high risk of developing diabetes and its complications. These two non-communicable diseases are not detected or diagnosed early when the symptoms have not yet manifested. Therefore, the aim of this study was to investigate the prevalence of pre-diabetes and undiagnosed diabetes mellitus of apparently healthy adults in Warri, Nigeria.
Methods: Glucose oxidase para-aminophenol spectrophotometric method was used to evaluate plasma fasting blood glucose concentrations in 420 adults within age limit of 21 to 85 years.
Results: Prevalence of pre-diabetes and diabetes mellitus were 10.7% and 8.3% respectively. Men had a higher prevalence of both pre-diabetes and diabetes mellitus of 12.4% and 9.5% respectively while prevalence of diabetes mellitus in females increased with age.
Conclusions: Prevalence of pre-diabetes and diabetes mellitus is increasing, and there is an urgent need for intervention relating to life style changes and frequent fasting blood glucose evaluation.

Key words: pre-diabetes, diabetes mellitus, fasting blood glucose, Nigeria.

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INTRODUCTION

Globally, diabetes is a health challenge and an issue of public health concern most markedly in the world's middle-income countries (1- 7). Diabetes mellitus is a disorder of multiple etiologies characterised by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both (8). Typical symptoms are hyperglycemia including polydipsia, polyphagia, polyuria, blurred vision, weight loss, and generalised pruritis. (9). Prior to these symptoms, diabetes is preceded by impaired fasting glucose (IFG) resulting in a pre-diabetic state that can exist undetected for many years (2,10).

Pre-diabetes is a practical term referring to impaired fasting glucose (IFG) and an impaired glucose tolerance which places individuals at high risk of developing diabetes and its complications (3,5,9,11). The World Health Organization's criteria for diagnosing pre-diabetes are a fasting plasma glucose of ≥6.1-6.9mmol.L^{-1} for pre -diabetes, while a fasting plasma glucose of ≥7.0mmol.L^{-1} meets criteria for diabetes mellitus (3). The longer a person lives with undiagnosed and untreated diabetes, the worse the health and social outcomes are likely to be, therefore early detection and diagnosis is the starting point for living well (1,7).

Globally, there are a total of 422 million adults (18+years) with diabetes of which 25 million are in the African region with a prevalence of 7.1% (1). In 2012 there were 1.5 million deaths worldwide directly caused by diabetes (1) and Nigeria is the most affected country with diabetes in the sub-Saharan region of Africa (12). The prevalence varied from 0.65% in rural Mangu village in northern Nigeria to 11.0% in Urban Lagos in southern

Nigeria (7). In the south East, prevalence of diabetes was 1.1% (13). Prevalence of pre-diabetes and undiagnosed diabetes mellitus was 9% and 7% respectively in the south-south (14). Recent studies in Agbor, Delta State, Nigeria reported a prevalence of 59% of Type 2 diabetes mellitus from suspected subjects with the risk of developing diabetes mellitus found to be increasing with age (15). Due to the reported rapid rise in prevalence of diabetes mellitus and pre-diabetes in Nigeria (1), there is a lack of data in south-south Nigeria. The aim of this study was to investigate the prevalence of pre-diabetes and undiagnosed diabetes mellitus in adults in the Warri Metropolis, Southern Nigeria.

MATERIALS AND METHODS

Study population
A total of 420 apparently healthy adults (210 male, 210 female) were recruited within the age limit of 21yrs to 85yrs from the Warri metropolis. Inclusion criteria were that all subjects were ambulant, while exclusion criteria were adults in wheel chairs, hospitalized, with stroke, ascites, catheterised, pregnant and nursing mothers, and diagnosed diabetic and hyperglycemic individuals. Informed consent was obtained from participants as well as ethical consent from the Ethics Committee of Central Hospital, Warri, Delta State, Nigeria. A structured questionnaire was designed to obtain information on age, gender and freedom from overt illness. Participants were required to have fasted for at least 12h (overnight) prior to blood glucose sample collection. The WHO criteria for diabetes were used in which

the fasting plasma glucose of participants was classified as normal: ≤ 6.0 mmol.L^{-1}), pre-diabetes: 6.1-6.9mmol.L^{-1}, or diabetes: (≥7.0 mmol.L^{-1} (16).

Sample collection and analysis

Venous blood was collected by standard venipuncture into fluoride-oxalate bottles and well mixed. The blood was centrifuged at 3000rpm for 10 minutes. The plasma was aliquoted into a plain tube, frozen, and analysed within 24hrs. Plasma blood glucose was analysed on a spectrophotometer using the GOD-PAP method by Barham and Trinder (17). All test kits used were a product of Randox Laboratories, UK, and used according to the manufacturer's instructions.

Statistical analysis

The group mean ±SD was calculated for glucose and significant difference between means and correlations were evaluated using GraphPad Prism 6 for software (La Jolla, California USA) windows with P<0.05 considered as statistically significant.

RESULTS

Out of the 420 samples from apparently healthy adults tested for fasting blood glucose, 45 (10.7%) had pre-diabetes (12.4% males, 9.0% females) while 35 (8.3%) had diabetes mellitus (males 9.5%,females 7.1%) respectively (Tables1 and 2). Table 2 also shows that males had a higher incidence of both pre-diabetes and diabetes mellitus (12.4% and 9.5% respectively) than women (9.0% and 7.1% respectively). The incidence of pre-diabetes was highest in the age group of 71-85 years (21.4%) and lowest in the age group of 41-50 years (2.0%) while incidence of diabetes mellitus was highest in two age groups of 61-70years and 71-85 years (12.9%) and lowest in age group of 31-40 years (2.9%), (Table 3 and Figure1). Table 3 demonstrates a statistically significant increase in the incidence of diabetes mellitus (p<0.05) as age group increased which is represented in Figure 1. Figures 2 and 3, and Table 4 demonstrates that frequency of pre-diabetic males was significantly higher in age group of 71- 85 years compared to females of the same age group and highest compared to other age groups in both females and males in the study population. However, the incidence of diabetes mellitus in females also increased with age (Table 3) with a significant increase (p=0.005) in mean fasting blood glucose between age groups in the study population.

DISCUSSION

Our study covered apparently healthy adults in the 21 to 85 age group unlike some previous studies which were limited to 65 years (1,16,18). The incidence of pre-diabetes in our study of 10.7% and diabetes mellitus of 8.3% were higher than 6.0% and 4.6% for pre-diabetes and diabetes mellitus reported in the Oke-ogun region of Oyo State of Nigeria (9), and higher than 1.1 % and 3.0% for pre-diabetes and diabetes respectively reported in Umudike, Nigeria (13). The incidence of diabetes in our study was higher than 2.8% of undiagnosed diabetes mellitus cases reported in Port Harcourt, Nigeria (18) and was also higher than 0.8% reported in the Uyo metropolis, Nigeria (16). The incidence in our study is similar to pre-diabetes of 9% and undiagnosed diabetes mellitus of 7% reported in Calabar, Nigeria (14). This study agrees with previous studies where the incidence of these two non-communicable diseases are increasing

in Nigeria and therefore there is need for intervention (7,15). Prevalence of pre-diabetes in our study was lower than 35% and the same with diabetes of 10.9% in a cross sectional study in China (19).

The statistically significant increasing prevalence of diabetes in age groups 31-40 and 71-85 age groups in our study agrees with reports from southern Nigeria (15) where it was observed that diabetes increases with age. The statistically significant increasing prevalence of diabetes with age in females agrees with studies that reported that females have a tendency to accumulate adipose as they increase in age (9,13), especially post-menopause and with relatively reduced physical activity (2). The higher prevalence of pre-diabetes and diabetes mellitus in men compared to women is similar to a study in Calabar (14), a Nigerian cosmopolitan city. The prevalence of diabetes in men, even though this did not increase in the 21-30 age group, showed a significant increase in the 31-40 to the 61-70 age groups which could be attributed to reduced physical activity as they advance in age. In the very advanced age group of 71-85 years, men in this study tended to have a leaner body mass because of their reduced food intake which could result in weight loss and consequent reduced blood glucose which may have contributed to the lower prevalence in this age group (2, 20).

The higher prevalence of pre-diabetes and diabetes in men compared women observed in our study agrees with another study (20) which could be associated with the extracurricular social life style of men because of urbanization.

CONCLUSIONS

Our study identified an increasing incidence of pre-diabetes and diabetes mellitus in the Warri metropolis compared to previous investigations undertaken in Nigeria. We therefore advocate appropriate intervention programs by government and non-governmental organisations for increased information and testing for pre-diabetes and for lifestyle changes, by appropriate health professionals to identify pre-diabetes and diabetes aimed at the prevention and treatment of diabetes mellitus.

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AUTHOR INFORMATION

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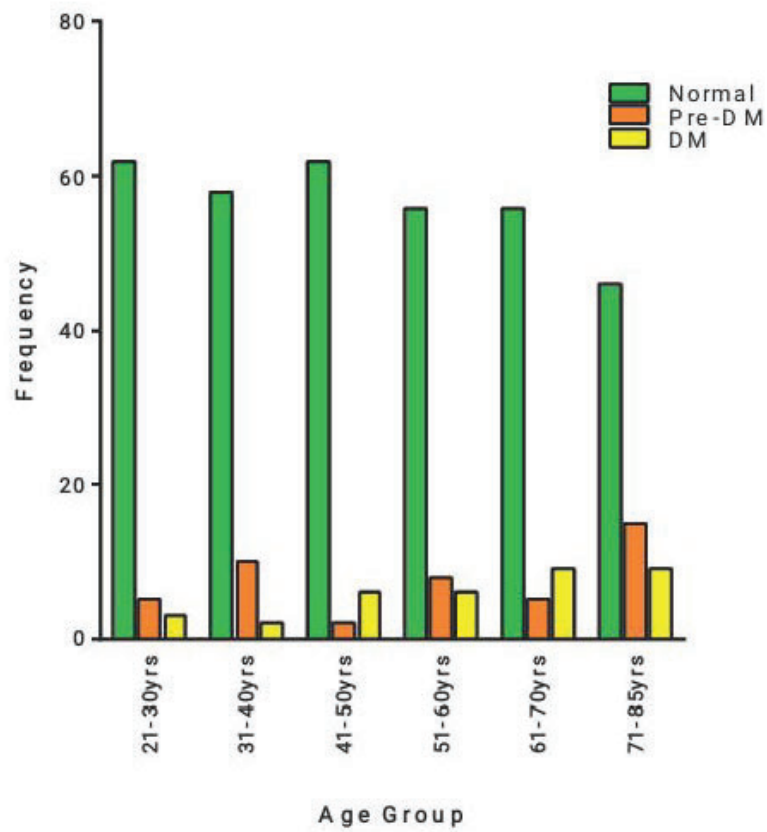**Correspondence:** Dominic Essiet.
E-mail: dominicessiet@yahoo.com

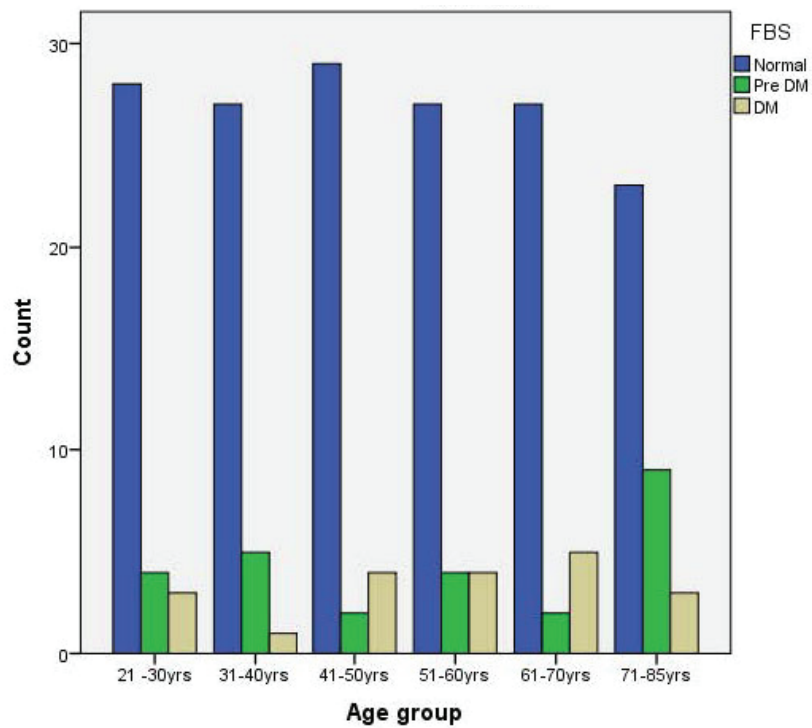**Figure 1:** Shows frequency of Normal, pre-Diabetes and Diabetes mellitus according to age groups in the study population.

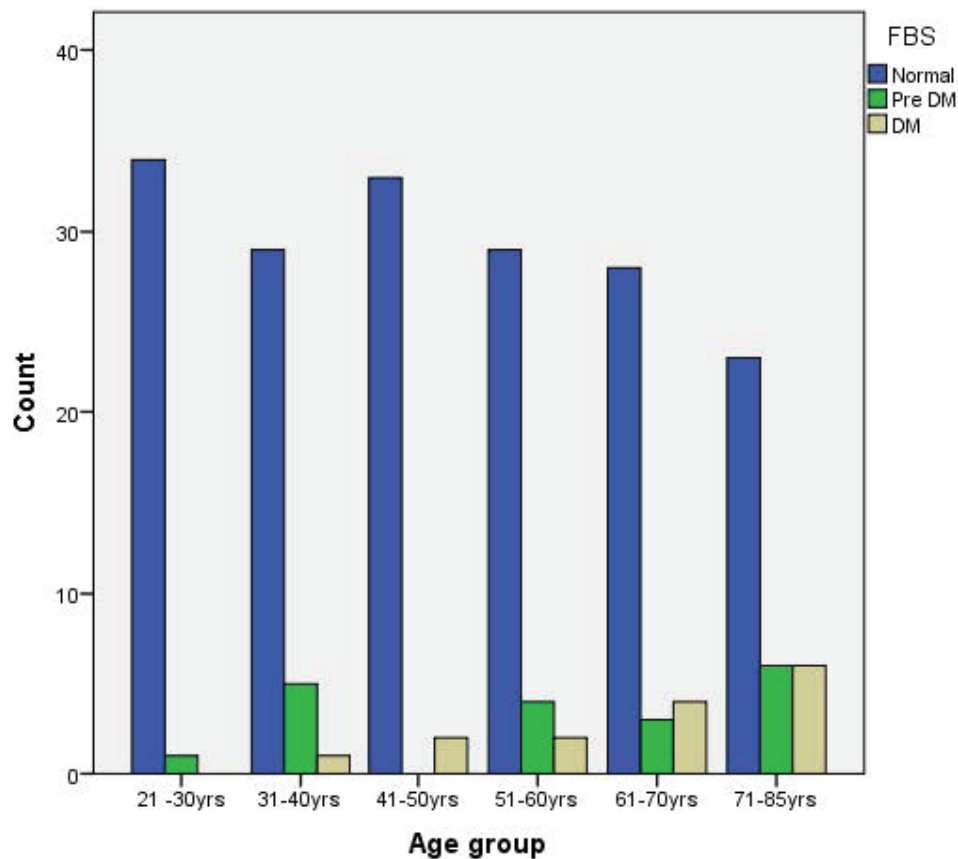**Figure 2:** Frequency of Normal, Pre DM and DM in male age groups

Figure 3: Frequency of Normal, Pre DM and DM in female age groups

Table 1. Incidence of pre-diabetes mellitus in the study population.

FBG Classification	No. of subjects	Prevalence (%)
Normal	340	81.0
Pre-Diabetes	45	10.7
Diabetes mellitus	35	8.3

Table 2. Incidence of pre-diabetes and diabetes mellitus according to gender in the study population.

FBG	Male	Female	X^2	P
Normal	164 (78.1)	176 (83.8)	2.227	0.328
Pre-Diabetes	26 (12.4)	19 (9.0)		
Diabetes	20 (9.5)	15 (7.1)		

Table 3. Fasting blood glucose (FBG) classification and incidence of pre-diabetes and diabetes mellitus according to age groups in the study population.

	21-30 yrs	31-40 yrs	41-50 yrs	51-60 yrs	61-70 yrs	71-85 yrs	P
FBG mmol/L ± sd	5.00 ± 0.14	5.01 ± 0.14	4.86 ± 0.14	5.11 ± 0.16	5.59 ± 0.27	5.61 ± 0.18	0.0005
Normal n (%)	62 (88.6)	58 (82.9)	62 (88.6)	56 (80.0)	56 (80.0)	46 (65.7)	0.006
Pre-diabetes n (%)	5 (7.1)	10 (14.3)	2 (2.9)	8 (11.4)	5 (7.1)	15 (21.4)	<0.05
Diabetes mellitus nu (%)	3 (4.3)	2 (2.9)	6 (8.6)	6 (8.6)	9 (12.9)	9 (12.9)	<0.05

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