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Assessment of Fasting Plasma Glucose Among Teenagers in Maiduguri Metropolitan Council

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Abstract

This study assessed the fasting plasma glucose among teenagers attending secondary schools in Maiduguri Metropolitan Council. A total of 300 subjects participated in this study which comprises of 150(50%) males and 150(50%) females. Subjects were aged 13-19 years old. Information about socio-demographic were obtained by a questionnaire. Anthropometric measurement of body weight and height were also taken. Their blood pressure was also measured. Fasting plasma glucose (FPG) was estimated using glucose oxidase method. The mean for age, body mass index (BMI), systolic and diastolic blood pressure were 15.75 ± 1.65 years, 21.38 ± 4.84 Kg/M², 117.73 ± 11.94 mmHg, and 72.98 ± 9.51 mmHg respectively. The mean FPG concentration was found to be 4.71 ± 0.88 mmol/l. The FPG was categorized in to normal, low probability, impaired FPG and diabetes mellitus. The FPG of 283(94.3%) subjects fall within the normal range, 16(5.3%) subjects had an impaired FPG and 1(0.3%) with confirmed diabetes mellitus. This study showed a significant positive correlation between FPG and BMI ($r = 0.215$; $p < 0.01$), and significant negative correlation between FPG and age ($r = -0.213$; $p < 0.01$). In conclusion,

our study has shown that 283(94.3%) of the subjects fall within the normal range, 16(5.3%) had an impaired FPG and 1(0.3%) had confirmed diabetes mellitus. Although the percentage of diabetes mellitus among the teenagers is low, there is need for more awareness campaign and possibly routine medical checkup for these teenagers to identify those who are at risk or are diabetics to facilitate effective management to prevent future complications associated with Diabets.

Keywords: Teenagers, Fasting plasma glucose, Diabetes mellitus, Secondary schools

Introduction

Diabetes mellitus is a group of diseases characterized by high levels of glucose in the blood resulting from defects in insulin production, insulin action, or both (National Diabetes Education Programme, 2011). High blood glucose, more specifically, diabetes mellitus is a major health problem (Serah *et al.*, 2004). Diabetes mellitus is a global public health problem with an extreme effect on the quality of life of affected patients (Abegunde *et al.*, 2007; Moodley and Rambiritch, 2007; Hjelm *et al.*, 2003) and its prevalence is

increasing at an alarming rate (Wild *et al.*, 2004).

Diabetes clinically is a non-communicable disorder but diabetics are at increased risk of diseases such as heart diseases, blindness, nerve disorders, kidney diseases, gangrene etc (Amos *et al.*, 1997; Adetuyibi, 1976 and Alberti *et al.*, 1975). The exact cause(s) of diabetes – induced complications are not fully understood, the underlying factor that appears to make those with diabetes more prone to many health problems is prolonged and frequent elevation of blood glucose.

Diabetes is one of the most common diseases in school-aged children. Type1 diabetes in U.S. children and adolescents may be increasing and many more new cases of type 2 diabetes are being reported in young people. About 215,000 young people in the US under age 20 had diabetes in 2010. Both type 1 diabetes and type 2 diabetes are increasing in U.S. children and adolescents. The Centers for Disease Control and Prevention provides statistics about Diabetes in the National Diabetes Fact Sheet (CDC, 2014).

About 75 percent of all newly diagnosed cases of type1 diabetes occur in individuals younger than 18 years of age. Currently, because 10 to 15 percent of children and teens are overweight – about double the number of two decades ago – increasing numbers of young people have type 2 diabetes (Ogden, 2002). In several clinics based studies, the percentage of children with newly diagnosed diabetes classified as type 2 has increased from less than 5 percent before 1994 to 30 to 50 percent in subsequent years (Fagot *et al.*, 2000 and Kaufman *et al.*, 2002).

Diet and lifestyle are the biggest culprits at least in the case of type 2 diabetes, but genetics also

have a role to play. Although obesity is an important factor in the diabetes epidemic, it does not alone explain the vast increase in prevalence especially in the developing world. The increasing prevalence rate of diabetes in children and adolescents globally is alarming, hence the need to check for the diseases among teenagers schooling in Maiduguri Metropolitan Council, the research area.

Materials and Methods

This research was carried out in four Secondary Schools in Maiduguri metropolis as our study area. Maiduguri metropolis is the capital and the largest city of Borno state in North Eastern Nigeria. A total of 300 secondary school students between the aged13 - 19 years were enrolled as the study subjects. A simple random technique was used to recruit the subjects. Written informed consent of participants was sought using a written informed consent form, and only those who accepted to participate in the study were included. Ethical clearance was obtained from the ethical committee of Borno State Ministry of Health and letter of recommendation from Borno State Ministry of Education.

Demographic data of subjects were compiled using a simple questionnaire, while 3 milliliters (3mls) of blood sample from each subject was collected into a fluoride oxalate container. The blood samples were spun using a centrifuge at 4000 revolutions per minute (rpm) for 5 minutes. Fasting plasma glucose was determined using Glucose Oxidase method as described by Trindar (1969). The data generated in this study was analysed using a statistical package for social science SPSS version 20.0 for windows. A descriptive statistic was carried on the data. The FPG levels of the subjects were correlated with their demographic data using Pearson linear correlation coefficient. A scatter



plot was done by Microsoft excel. A p-value ≤ 0.05 was considered as statistically significant.

Fasting plasma glucose interpretation as defined by International Society for Pediatric and Adolescent Diabetes (ISAPD, 2014) was used for the classification as follows:

≤ 5.6 mmol/L (≤ 100 mg/dL) - Excludes diabetes (probably)

5.6–6.9 mmol/L (110–125 mg/dL) - Impaired fasting glucose, indication for diagnostic testing

≥ 7.0 mmol/L (≥ 126 mg/dL) - Indicates diabetes, confirmation with repeat testing required.

Results

Table 4.1 presents the frequency and percentage distribution of subjects according to gender, amongst which 150(50%) were males and 150(50%) were females. The mean FPG was 4.71 ± 0.88 mmol/L, mean age = 15.72 ± 1.65

years, mean BMI = 21.38 ± 4.84 Kg/m², mean systolic BP = 117.73 ± 11.94 mmHg, and mean diastolic BP = 72.98 ± 9.51 mmHg (table 2). There was no significant difference ($p > 0.05$) in the mean Fasting plasma glucose, age, BMI and systolic blood pressure of male and female subjects. However, the mean diastolic blood pressure was significantly ($p < 0.05$) lowered in male as compared to the female subjects (table 3). There were 283 (94.3%) subjects with normal FPG, 16(5.3%) showed low probability diagnostic values. 16(5.3%) were found with impaired FPG and 1(0.3%) with confirmed diabetes mellitus (table 4). There was a negative and significant correlation between FPG and age ($r = -0.213$; $p < 0.01$), while a positive and significant correlation was observed between FPG and BMI ($r = 0.215$; $p < 0.01$) as presented in table 5. The correlation plots are shown in figures 1 and 2.

Table 1. Frequency and percentage distribution of subjects according to Gender.

Gender	Frequency	Percentage
Male	150	50.0
Female	150	50.0
Total	300	100

Table 2. Means \pm SD of biochemical and demographic variables of the study subjects.

Variables	Means
FPG (mmol/L)	4.71 ± 0.88
Age (years)	15.72 ± 1.65
BMI (kg/m ²)	21.38 ± 4.84
Systolic BP (mmHg)	117.73 ± 11.94
Diastolic BP (mmHg)	72.9833 ± 9.51

Table 3. Comparison of means \pm SD of biochemical and demographic variables in male and female subjects

Variables	Male	Female	p-value
FPG (mmol/L)	4.62 \pm 0.54	4.80 \pm 1.11	0.12
Age (years)	15.78 \pm 1.77	15.66 \pm 1.52	0.54
BMI (kg/m ²)	20.97 \pm 4.44	21.74 \pm 5.17	0.54
Systolic BP (mmHg)	117.26 \pm 10.73	118.19 \pm 12.96	0.50
Diastolic BP (mmHg)	71.84 \pm 10.37	74.09 \pm 8.49	0.04

Table 4. Frequency and Percentage distribution of FPG according to normal impaired fasting glucose and diabetes among the study subjects.

Diabetic Status	Frequency	Percentage
Normal (\leq 5.6mmol/L)	283	94.3
IFG (5.6 -6.9mmol/L)	16	5.3
Diabetes (\geq 7.0mmol/L)	1	0.3
Total	300	100.0

Table 5. Correlation of FPG with age and BMI.

Variables	r- value	p- value
FPG & Age	- 0.213	<0.01
FPG & BMI	0.215	<0.01

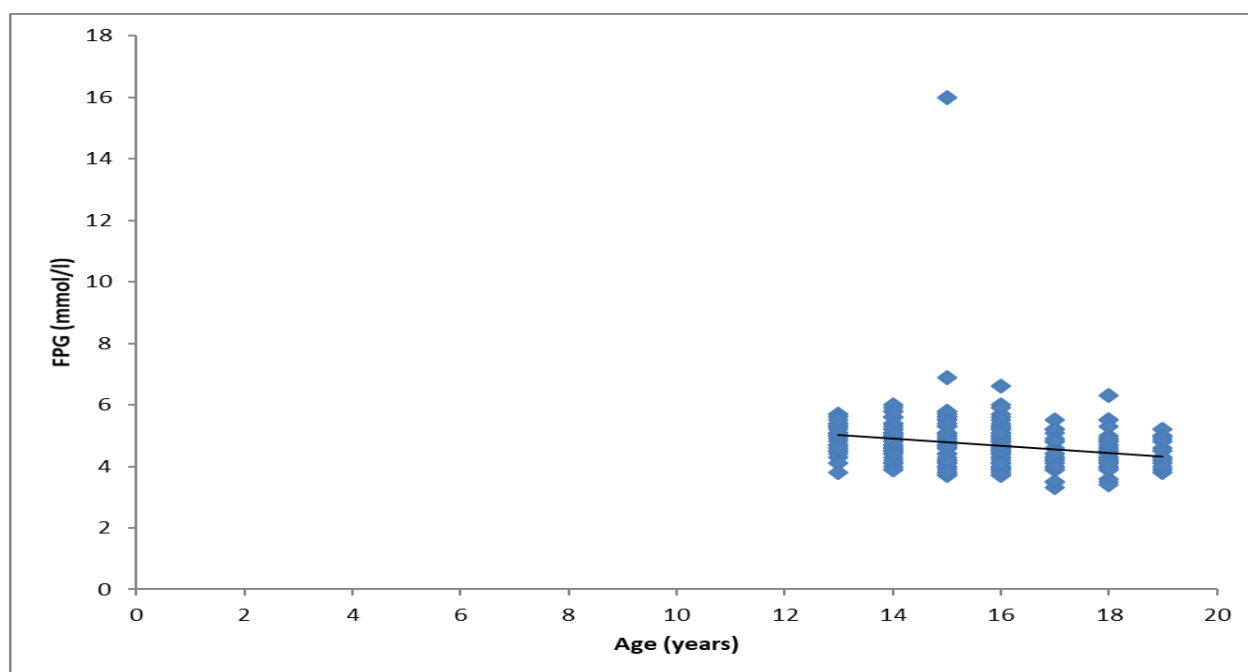


Fig 1. Correlation plot between Fasting plasma glucose and Age

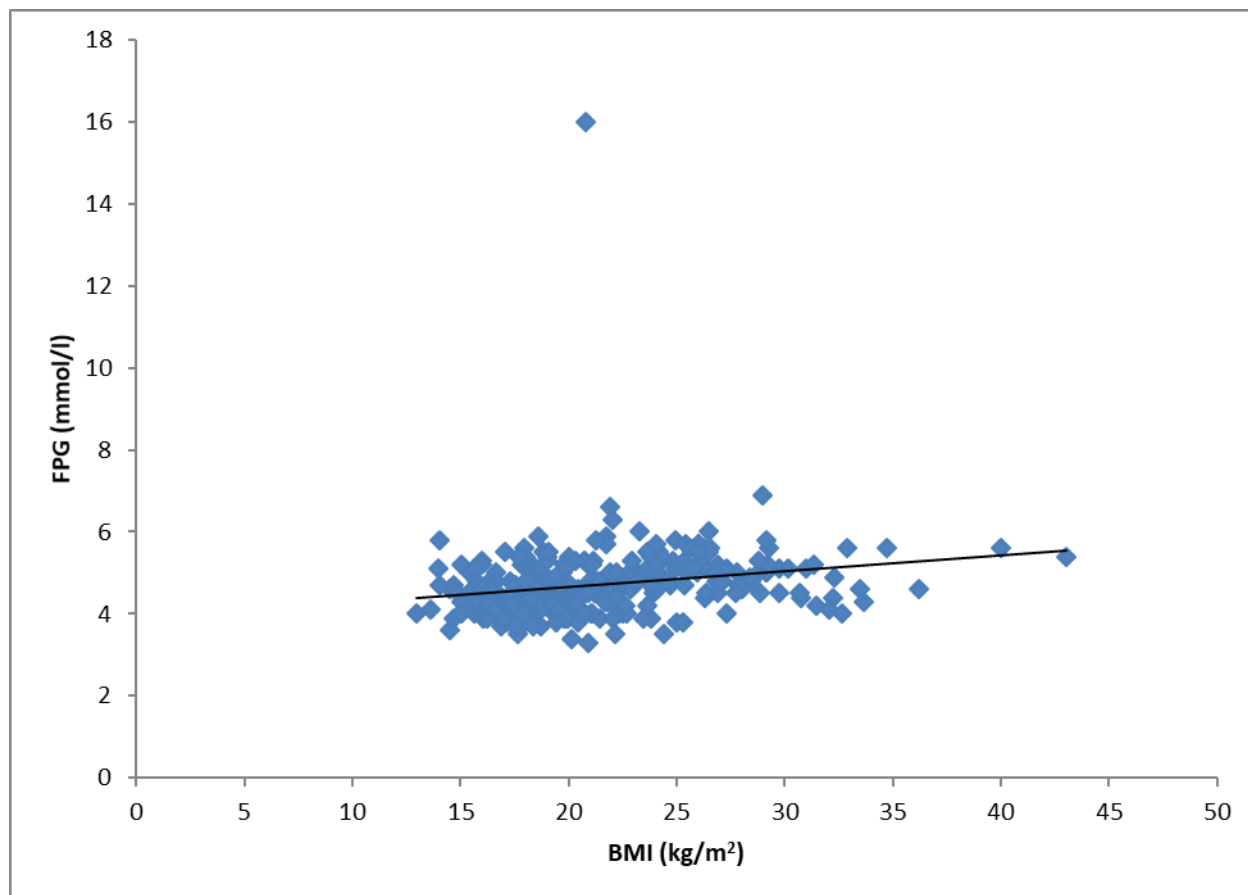


Fig 2. Correlation plot between fasting plasma glucose and BMI

Discussion

This study was aimed at determining the prevalence of diabetes mellitus in teenagers attending secondary schools in Maiduguri metropolitan council. In this study, the mean FPG concentration was found to be 4.71 ± 0.88 mmol/L for the 300 teenage subjects. Our study shows no significant difference in the means of Fasting plasma glucose in male as compared to female subjects ($p > 0.05$). This finding concurred with a previous report (Shehu et al., 2013) which indicated that food availability is fairly maintained in urban areas.

The mean diastolic blood pressure was significantly higher in females than the male subjects. Our finding was also similar to that of Mahmood (2006) who found out that Iraqi primary school children aged 10-12 years

manifested higher diastolic and systolic blood pressure than boys. There was no significant difference in the mean BMI of male and female subjects. From the table above, the BMI of both genders were within the normal range. This may be due to the fact that people within this age bracket are usually very active and are at the very peak of their strength (Shalom and Opeyemi, 2014).

From our research out of 300 subjects studied, 283(94.3%) had normal fasting plasma glucose, 16(5.3%) showed impaired fasting glucose and 1(0.3%) was found to be diabetic. Those pupils with impaired fasting plasma glucose and the diabetic one had history of diabetes in their family based on their questionnaire. The sedentary life style of the pupils may also contribute to the elevation of their plasma glucose; most of them eat fast food before

coming to school. This finding is similar to earlier studies conducted in the United States of America by Stang (2005) who found out that 1(0.25%) in every 400-600 children were diagnosed with diabetes.

Our study also showed a weak negative correlation between FPG and Age of the subjects. This finding is consistent with a previous report (Chris *et al.*, 2012). Also, a weak positive correlation was observed between FPG and BMI. This finding is consistent with a previous report (Onyesom *et al.*, 2013).

In conclusion, our study has shown that 283(94.3%), subjects fall within the normal range, 16(5.3%) had an impaired FPG and 1(0.3%) with confirmed diabetes mellitus. The percentage of diabetes mellitus among the teenagers is low, but this call for awareness campaign and routine medical checkup for these teenagers to avoid future complications of diabetes. Measuring FPG and BMI could help in identifying pupils at high risk at an early age, and at the same time to give awareness so that their life style can be modified to stop the onset of the disease.

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Conflicts of Interest

There were no conflicts of interest in this study.

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