Original Article

Is screening for type 2 diabetes worthwhile in adolescents and young adults in developing countries?

R M Gali, D S Mshelia, Y P Mamza and J Adeonote

Abstract

Reports of the age of diagnosis of type 2 diabetes are declining, with a paucity of information in Africa. We therefore screened young university undergraduates to determine the current status of fasting plasma glucose among adolescents and young adults in Africans living in Africa. Two hundred and thirty (230), age range 18 to 35 years, participated in the study. Mean (±SD) age was 23±6y, BMI 22.2±3.8 kg/m^2, and fasting plasma glucose (FPG) 4.1±0.6 mmol/L. There was a positive but not a statistically significant correlation between BMI and FPG , but a statistically significant correlation between BMI and FPG in males but not in females. No subjects were found to have type 2 diabetes.

Introduction

Type 2 diabetes was once a disease occurring primarily, if not exclusively, in adults. Today the age of diagnosis is disquietingly declining accounting for about 8% to 45% of all new cases of diabetes in children and teenagers.[1–4] Various centres have reported a 10 to 30-fold increase in American children with type 2 diabetes in the past 10 to 15 years, and in the next 15 years it is anticipated that the global incidence of type 2 diabetes in children and adolescents will increase by up to 50%.[2,3,5] An alarming increase is also noticed in Canada,[6] the UK,[7] urban South-Asia,[8] and Japan.[9] Hence there seem to be increasing reports of type 2 diabetes in children and adolescents worldwide[10] but a paucity of reports from Africa.[11] However, according to a World Health Organization (WHO) non-communicable disease (NCD) surveillance report,[12] and a report from the WHO regional office for Africa[13] on the emerging NCD epidemic in that continent there is a wide dichotomy of prevalence of type 2 diabetes between rural and urban areas, mainly due to a 'westernised' lifestyles, which are of concern to African diabetes services.

The most important factor associated with the epidemic of type 2 diabetes and its declining age of onset is overweight/obesity and this appears to be due to increased calorie intake and a sedentary lifestyle.[14–16]

About half of patients with type 2 diabetes are diagnosed without symptoms and 50% have at least one diabetes-specific complication on diagnosis. Subsequently, the focus is increasing on the prevention, detection, and effective treatment of diabetes.

We have screened young university undergraduates to demonstrate whether the declining age of onset of type 2 diabetes noticed in developed nations has started to manifest itself among adolescents and young adults in Africans living in Africa.

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Patients and methods

Two hundred and thirty (230) undergraduate students (134 males and 96 females) from the University of Maiduguri were informed and consented to participate in the study. Those with a known history of diabetes, hypertension, and other related endocrine disorders, or those on medication that might influence plasma glucose were excluded from the study.

The study was approved by the Ethics Committee of Joint University of Maiduguri Teaching Hospital/ University of Maiduguri.

After an overnight fast for 12 to 14 hours, students were weighed with a portable weighing scale (HANA weighing scale), measured to the first decimal fraction of kilograms, their height measured, and Body Mass Index (kg/m^2) determined. Their blood pressure (BP) was taken using a mercury sphygmomanometer.

Venous blood was drawn aseptically from the antecubital fossae and delivered into a sodium fluoride oxalate container. Samples were centrifuged at 4000 rpm for 5 minutes and analysed immediately using the glucose oxidase method as described by Trinder.[17]

Descriptive statistics of variables were determined. The differences of mean±SD of variables between sexes were compared using Student's t-test. Correlations between plasma glucose and BMI, and glucose and age were done using Pearson's correlation coefficient. A graph of glucose against age was plotted to see if plasma glucose

increased with age. Also a graph of glucose against BMI was plotted to demonstrate changes in plasma glucose with increasing BMI.

P values of ≤0.05(95% confidence interval) were considered significant.

Results

Table 1 shows the characteristics of the screened students. Of the 230 students, 134 (58%) were males while 96 (42%) were females. The mean ±SD age of participants was 24±3 years (range 18–35), 11% were 20 years and below and 4% were 30 years and above. The male students were older than their female counterparts (25±3 versus 22±2 years) (p=0.001).

The mean BMI of the students was 22.2±3.8 kg/m^2. Females were significantly heavier than the males (22.9±4.8 kg/m^2 versus 21.7±2.8, p=0.02). There were 12% of students underweight (BMI<18.5), 69% had normal weight (18.5–24.9 kg/m^2), 14% were overweight (BMI 25.09 kg/m^2), and 5% were obese (BMI≥30.0).

The mean fasting plasma glucose (FPG) was 4.1±0.6§mmol/L and there was no statistically significant difference between males and females (4.1±0.6 mmol/L versus 4.1±0.6 mmol/L), p=0.20. The highest FPG recorded was 5.6mmol/L. There was a positive, but not statistically significant, correlation between BMI and FPG for the whole students(r=+0.042, p>0.05), but there was a positive and statistically significant correlation between BMI and FPG in males (r=+0.217, p<0.05), though not in females (r=-0.092, p>0.05). When FPG was plotted against BMI it showed a linear increase as BMI increases (see Figure 1). However, a graph of FPG versus age did not demonstrate an increase in plasma glucose with increasing age (see Figure 2).

Discussion

In this study, the decision to focus on young adults was based on the observation that the age of onset of type 2 diabetes is declining. Most (79%) of the students studied were 25 years and below and only 4% were over 30 years. Females were found to be heavier than their male counterpart, in keeping with Bakari's report that BMI is indeed higher among females than in males in northern Nigeria.[18] The FPG levels were within the reference range for the study laboratory, and FPG did not increase with increasing age, which is usually noticed in individuals of 40 years or older.[19]

Table 1 Characteristics of the screened students

	Males (n=134)	Females (n=94)	Significance
Age (yrs)	25± 3	22±2	p=0.001
FPG (mmol/L)	4.1±0.6	4.1 ± 0.6	p=0.200
BMI (kg/m^2)	21.7±2.8	22.9 ± 4.8	p=0.020

BMI =Body Mass Index
FPG =Fasting plasma glucose
Figures are expressed as means±SD

Figure 1 Graph demonstrating the relationship between FPG andBMI

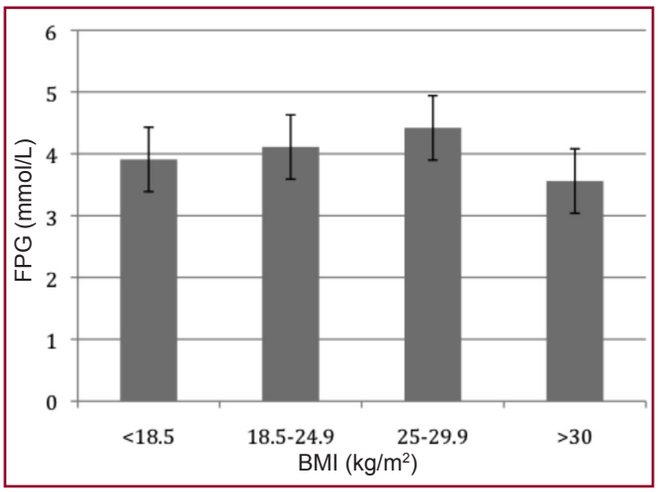
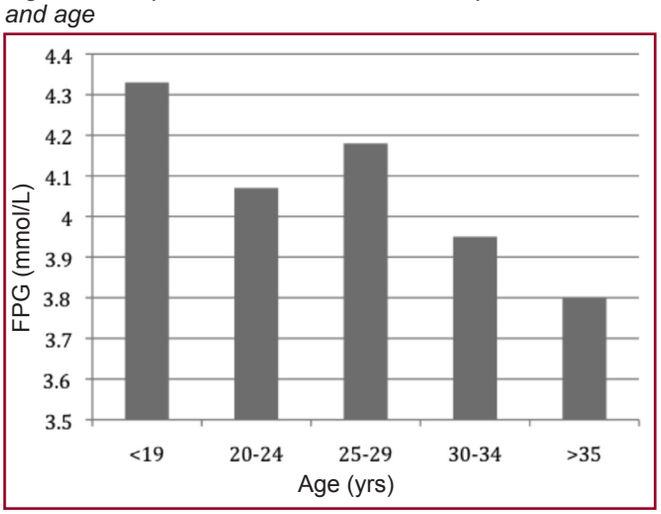


Figure 2 Graph to demonstrate relationship between FPG and age



Type 2 diabetes is a complex metabolic disorder of heterogeneous aetiology with social, behavioural, and environmental risk factors unmasking the effect of genetic susceptibility[20]. However, the recent increase observed in diabetes prevalence has occurred too quickly to be the result of increased genetic frequency and altered genetic pool, emphasizing the importance of environmental factors especially obesity. Obesity is said to be a hallmark of type 2 diabetes and 60–70% of type 2 adult diabetic patients are associated with overweight/obesity,[21] and up to 85– 95% of affected children, a finding that has been consistent in almost all reports,[4,10,14,15] hence the word 'diabesity' coined by Zimmet.[14]

The steady gain in the prevalence of obesity over the last 25 years in developed countries has affected the entire population, and no racial or ethnic group, region, or socioeconomic group has been spared. In Africa-American children, as BMI increases, insulin-stimulated

glucose metabolism decreases and fasting insulin levels increase.[3] Similarly, it was also demonstrated in a 7-year longitudinal study that the strongest predictor for increase in both insulin and glucose concentrations was an increase in BMI.[15] This parallelled the reports of emerging epidemics of type 2 diabetes in children and adolescents.[2, 3, 5, 6,10,14,15]

The decision to screen young adults in this study was generated from the fact that:

- a WHO NCDs surveillance strategy reported that over a period of 30 years the burden of NCDs for developing countries is expected to rise by over 60% by 2020, compared with under 10% in developed countries[12];
- a report from the WHO regional office for Africa raised an alarm of emerging NCDs, especially diabetes in Africa[13];
- there is a wide dichotomy in the prevalence of diabetes between urban (>20%) and rural areas (<2%).[13]

All these are due to so-called 'westernised' lifestyle changes.

Use of FPG as a screening test for type 2 diabetes may be recommended because:

- Many individuals who meet the criteria for diabetes are asymptomatic and are unaware that they have the disorder.
- Epidemiological studies suggest that type 2 diabetes may be present for at least 5 years before diagnosis.
- As many as 50% of individuals with type 2 diabetes have one or more diabetes-specific complications at the time of diagnosis.
- Treatment of type 2 diabetes may favourably alter the natural history of the disease; and (e) the risk of chronic complications increases as a functions of the duration of hyperglycaemia.[21–23]

Although the epidemics of obesity and type 2 diabetes in general and in particular among children and adolescents are yet to be noticed in an epidemic proportions in Africans living in Africa,[11,13] the so-called westernised lifestyle is well recognised, especially among those who are economically improved. The lifestyle of children and adolescents is increasingly involving unhealthy diets and reduced exercise, both favouring an increase in diabetes and obestiy prevalence.

However, this preliminary report may alleviate the fear of declining age of onset of type 2 diabetes in the developing countries, at least for the present.

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