RELATIONSHIP BETWEEN RANDOM BLOOD GLUCOSE LEVELS AND BODY MASS INDEX AMONG RURAL ADULTS IN NORTH CENTRAL NIGERIA

Etukumana E. A[1]., Puepet F. H.[2], Obadofin M. O.[3]

[1] *Department of Family Medicine, University of Uyo Teaching Hospital, Uyo, Nigeria*
[2] *Department of Internal Medicine, University of Jos Teaching Hospital, Jos, Nigeria*
[3] *Department of Family Medicine, University of Jos Teaching Hospital, Jos, Nigeria*

ABSTRACT

Background

Obesity, usually assessed using Body Mass Index (BMI), has been identified as one of the risk factors for type 2 Diabetes mellitus. However, there are mixed reports on the relationship between blood glucose levels and BMI

Objective

The objective of this study was to determine the relationship between Random blood glucose levels and Body Mass Index among rural adults in North Central Nigeria.

Methods

We carried out a cross-sectional descriptive study between February and May 2005. Seven hundred and fifty subjects who were ≥15years were sampled using systematic sampling technique. Data were collected with a structured questionnaire. Subjects were measured for height (m) and weight (kg); the Body Mass Index (BMI) was calculated. Blood samples of subjects were used for the estimation of blood glucose concentration using the glucose oxidase method of Trinder

Results

The study population consisted of 385(51.3%) males and 365(48.7%) females (male: female= 1.05:1). The mean age of the study population was 39.42±16.17years while the mean ages of the males and female were 35.23±14.09years and 43.83±17.04years respectively (t=7.55, p<0.001). The mean Random Plasma glucose level (RPGL) in the study subjects was 5.68(±2.16)mmol/L [males 5.69(±2.42)mmol/L and females 5.67(±1.86)mmol/L, t=0.11, P=0.91]. The mean BMI of the subjects was 23.86(±4.01)kg/m^2 [males 23.19(±3.23)kg/m^2 and females 24.56(±4.56)kg/m^2, t=4.75, P<0.001].There was no relationship between random blood glucose levels and BMI of study subjects(r=0.00, P=0.30).

Conclusion

We found no relationship between the levels of random blood glucose and Body Mass Index among the rural adult in the north central Nigeria. It seems BMI would not be a good predictor of Diabetes Mellitus among rural adults.

KEY WORDS: *Rural, Blood, Adults, glucose, obesity*

INTRODUCTION

Diabetes Mellitus is one of the non-communicable diseases and public health problems facing the world.[1,2] Diabetes Mellitus(DM) is define as a metabolic disorder of multiple aetiology characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat, and protein metabolism resulting from defects in secretion and /or insulin.[3,4] Diabetes mellitus is classified into type 1, type 2, other specific types and gestational.[4,] Diabetes mellitus which may be asymptomatic, especially type 2, can be diagnosed by estimating the level of glucose in the blood.[3,4] Obesity is regarded as risk factor for various chronic diseases including diabetes mellitus.[5-7] Interestingly, overweight and obesity are on the rise in Africa and might take epidemic proportion in the near future.[8] In

Correspondence :Etiobong.A.Etukumana
Department of Family Medicine
University of Uyo Teaching Hospital
Uyo – Akwa Ibom State
E – mail-etukumana@yahoo.com

addition, sub-Saharan Africa accounts for a large proportion of diabetes mellitus in the world with overall prevalence rate of 1-2% and this burden is expected to increase by 161% by 2030.[9] It has been established, based on principles, that fatty acids which constitute the body fat content can be synthesized from simple carbohydrate such as glucose; thus, an increase in blood glucose level has been associated with increase in lipid biosynthesis (lipogenesis) resulting in increase in weight.[10] Since Body Mass Index (BMI) is proportional to weight from its formula "weight/square of height", the influence of blood glucose on weight will ultimately affect BMI.[10] BMI is commonly used as an indicator of overall obesity in adults due to its simplicity and correlation with percentage body fat.[11] Body mass index does not, however, adequately characterize the distribution of body fat, because excess intra-abdominal fat is an independent predictor of health risk.[12] There are mixed reports on the relationship between blood glucose levels and BMI. Several studies have shown relationship between the levels of blood glucose and BMI in adult.[13-16] while others show no such relationship.[17,18] We postulated that there is no relationship between the levels of blood glucose and BMI among rural adults in Nigeria. To address this hypothesis, the objective of this study was to determine the relationship between blood glucose levels and body mass index among rural adults in North Central Nigeria.

Subject ad Methods

Study setting

This was carried out in Zawan community, a rural settlement about 20 kilometers outside Jos city, North Central Nigeria. The population of Zawan community was 4,443(National Population Commission Census 1991, Plateau State).[19] By the end of 2004, its population was estimated at 6520 based on an expected annual increase of 3%. The majority of the inhabitants of Zawan are Berom natives and they share similar cultural beliefs and practices. The church, the market square and the community leaders were used to mobilize the members of this community to Our Lady of Apostles Hospital, Zawan. The hospital has a 90-bed capacity and provides primary and secondary health care.

Research subjects

We carried out a cross-sectional descriptive study between February and May 2005. The sample size of the study was obtained using the national Diabetes mellitus prevalence rate of 2.2%[20] and 1% sampling error. Seven hundred and fifty subjects who were ≥ 15years were sampled using systematic sampling technique. Each recruited subject was given information regarding the research objectives in English or the local language (Hausa or Berom) as appropriate. Pregnant women and ill subjects were excluded. Written informed consent was obtained from the subjects before enrolment into the study. The subjects were assured of confidentiality of the data. Permission and co-operation for the study was obtained from the community leader of Zawan and management of Our Lady of Apostles Hospital, Zawan. The study was approved by the Ethical Committee of the Jos University Teaching Hospital, Jos, Nigeria. Data on sociodemograhic information were collected with questionnaire. Subjects were measured for height without shoes with a stadiometer and the measurement taken to the nearest centimeters.[21] Weights were recorded in kilograms using a flat scale with subjects wearing light clothes and without shoes.[21] Body Mass Index (BMI) was calculated as weight (kg) divided by square of height (m^2).[22]

Blood samples (without regard to time of last meal) were collected from subjects for the estimation of blood glucose concentration using the glucose oxidase method of Trinder.[23]

Statistical Analysis

Data entry and analysis were done with Epi Info 3.2.2 (CDC, Atlanta Georgia, USA). The frequencies of categorical variables and means of continuous variables were determined. All P-values less than 0.05 were considered significant.

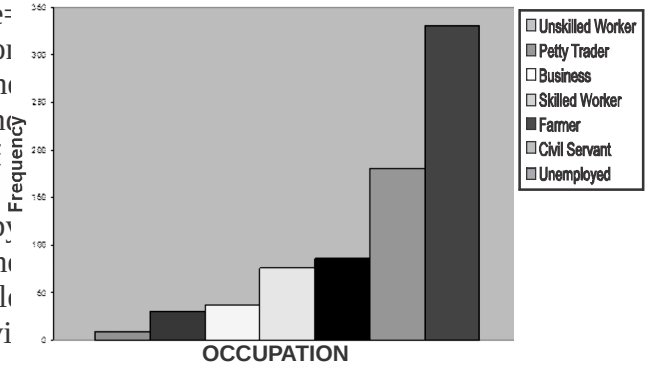
Results

Seven Hundred and fifty subjects were recruited for the study by the investigators. The age and sex distribution of the study subjects is shown in table 1. The study population consisted of 385(51.3%) male and 365(48.7%) females (male: female 1.05:1). The mean age of the study population was 39.42±16.17years. The mean ages of the males and female were 35.23±14.09years and 43.83±17.04years respectively (t=7.5 p<0.001).

Table 1
Age and Sex Distribution of the Subjects

Age group(yr)	Males (%)	Females (%)	Total (%)
15-24	96(63.6)	55(36.4)	151(20.1)
25-34	110(62.5)	66(37.5)	176(23.5)
35-44	70(50.7)	68(49.3)	138(18.4)
45-54	74(49.3)	76(50.7)	150(20.0)
55-64	21(29.2)	51(70.8)	72(9.6)
65-74	7(22.6)	24(77.4)	31(4.1)
75-84	7(21.9)	25(78.1)	32(4.3)
Total	385(51.3)	365(48.7)	750(100)

Figure 1
OCCUPATIONAL DISTRIBUTION OF STUDY POPULATION



The distribution of the study population by occupation is as shown in figure 1. Most of the subjects were unemployed 331(44.1%) while most of the employed subjects were civil servants 181(24.1%).

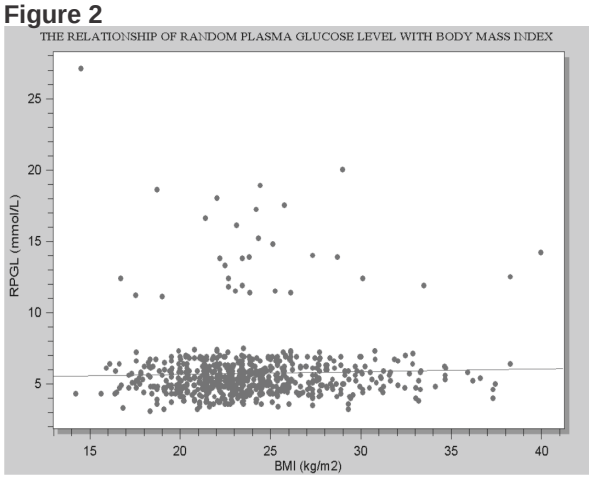
The mean (±SD) Random Plasma glucose level (RPGL) in the study subjects was 5.68(±2.16)mmol/L [males 5.69(±2.42)mmol/L and females 5.67(±1.86) mmol/L, t=0.11, P=0.91]. The mean (±SD) BMI of the subjects was 23.86(±4.01)kg/m^2 [males 23.19(±3.23)kg/m^2 and females 24.56(±4.56)kg/m^2, t=4.75, P<0.001].

The relationship of RPGL (mmol/L) to BMI (kg/m^2) of the study is as shown in figure 2. There was no relationship of RPGL with BMI of study subjects(r=0.00, P=0.30).

Discussion

There was no relationship between Radom blood glucose levels and body mass index in this study. This result is in agreement with similar studies[17,18] but contradicts other reports[13-16] which have established relationship between blood glucose levels and body mass index. The result of our study is not surprising since it was observed in Horn study that the waist to hip ratio and not body mass index remains the important independent predictor of Diabetes Mellitus.[24,25] In addition, studies[18,25] have supported the use of waist circumference rather than body mass index as predictor of Diabetes Mellitus and this may be

Figure 2



responsible for the lack of relationship between the random blood glucose levels and BMI. In fact, studies have stated that body mass index does not, however, adequately characterize the distribution of body fat, because excess intra-abdominal fat is an independent predictor of health risk.[12,26] Hence, guidelines recommend measurement of waist circumference and waist-hip ratio which correlate with visceral fat and indirectly measures central adiposity.[12,26,27]

Simple random sampling of a defined population would have been ideal for this study but this was not possible because of the large size of the population used. However, a systematic sampling technique was employed for this study. We were unable to do fasting blood glucose for the subjects which would have been, perhaps, a better predictive index for the establishment of the relationship between blood glucose levels and body mass index. These are the limitations of this study.

In conclusion, we found no relationship between levels of random blood glucose and body mass index among the rural adults in the North Central Nigeria. It would appear that it would be better to use other predictors of Diabetes Mellitus rather than body mass index among rural adults.

References

1. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes estimates for the year 2000, and projections for 2030.Diabetes care 2004; 27: 1047-53.
2. King H, Rewers M. Diabetes in adults is now a third world problem. Bull of WHO 1991;69:643-8.
3. WHO study group on diabetes mellitus. Geneva ; World Health Organisation, 1985 (WHO Technical Reports Series No 727).
4. Aberti KGMM, Zimmet PZ for the WHO consultation. Definition, diagnosis and classification of diabetes mellitus and its complications. Part I : diagnosis and classification of diabetes mellitus. Provisional report of a WHO consultation. Diabetic Medicine 1998 ; 15 :539-553.
5. Noel PH, Pugh JA. Management of Overweight and Obese adults. BMJ 2002; 325:757-761.
6. World Health Organization. Obesity: Preventing and managing the global epidemic. Geneva : WHO, 1997 (WHO Technical Report series NO 894).
7. National task force on the prevention and treatment of obesity. Overweight, Obesity and health risk. Arch Intern Med 2000; 160:898-904.
8. Ziraba AK, Fotso JC, Ochako R. Overweight and obesity in urban Africa: A problem of the rich or the poor? BMC Public Health 2009;9:465.
9. King H, Rewers M. Diabetes in adults is now a third world problem. Bull of WHO 1991;69:643-8.
10. Nelson DL, Cox MM. Lehninger Principles of Biochemistry. 4th Edition. New York: W.H Freeman and Company, 2005.
11. Gallagher D, Visser M, Sepulveda D, Pierson RN, Harris T, Heymsfield SB. How useful is body mass index for comparison of body fatness across age, sex, and ethnic group. American Journal of Epidemiology 1996;143(3) 228-239.
12. Executive Summary of the clinical guidelines on the identification, evaluation and treatment of overweight and obesity in adults. Arch Intern Med 1998: 158: 855-57.
13. Bakari AG, Onyemelukwe C, Sani BG, Aliyu S, Hassan SS, Aliyu TM. Relationship between casual blood sugar and body mass index in a sub urban Northern Nigerian population: a short communication.

Niger J Med 2007; 16(1):77-8.
14. Onyeson I, Oweh OT, Etumah OS, Ifie EJ. Correlation between body mass index and blood glucose levels among some Nigerian Undergraduates. DOI: http://dx.doi.org/10.7243/2050-08874-2-4 © 2013 E Josiah et al; licensee Herbert Publications Ltd. accessed on 8/4/2013.
15. Cao By, Mi J, Gong Cx. Blood glucose profile in children and adolescents in Beijing area. Zhonghua Er ke za Zhi 2008; 46(4): 297-300.
16. Pranita A, Phadke AV, Singh R, Joshi AR. Correlation of BMI with Fasting blood glucose in perimenopausal women. Indian J Physiol Pharmacol 2011; 55 (4): 390-391.
17. Jangborbain M, Hedley AJ, Jones RB. Is the association between glucose levels and "all causes" and cardiovascular mortality risk, dependent on body mass index? Met J IR I 1991; 6: 205-212.
18. Shinta Larasati H, Intan Nevita OB, Puspa Krisna R, Eva Susiyanti. Waist Circumference as a predictor for blood glucose levels in Adults. Universa Medicina 2009; 28(2):77-82.
19. National population commission census 1991 results, Plateau State
20. Akinkugbe OO (Ed). National expert committee on non-communicable diseases in Nigeria: report on a national survey. Federal Ministry of Health, Nigeria, 1992
21. Dowse GK, Zimmet P. A model protocol for diabetes and other non- communicable disease field survey. World Health Statistics Quarterly 1992; 45: 360-372
22. National Institute of Health: National Heart, Lung, and Blood institutes. Clinical guidelines on the identification, evaluation and treatment of overweight and obesity in adults; the evidence report. Obes Res 1998; 6(supp 2) : 515-2095
23. Trinder P, Barham D. Enzymatic colorimetric test method-without deproteination. Analyst, 1972.
24. De Vegt F, Dekker JM, Jager A. Relation of impaired fasting and post load glucose with incidence of type 2 diabetes in Dutch population: the Horn study. JAMA 2001; 285: 2109-13.
25. Snijder MB, Dekker JM, Visser M, Bouler LM, Stehouwer CD, Kostense PJ et al. Association of hip and thigh circumference with the incidence of type 2 diabetes: the horn study. Am J Clin Nutr 2003; 77(5): 1192-97.
26. Screening for obesity. Guide to clinical preventive services: report of the task force, 2nd ed. Washington: US preventive services task force, 1996: 219-29
27. Lean MEJ, Han TS, Morrison CE. Waist circumference as a measure for indicating need for weight management. BMJ 1995;311:158-161.