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Effects of Body Mass Index (BMI) on blood glucose levels among Sudanese pregnant women at Dream Maternity Hospital, Khartoum, April, 2017

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Abstract

Background: The incidence of glucose intolerance in Sudanese pregnant women was found to be within the universal estimates. BMI is considered by many authors a risk factor for pregnancy glucose intolerance. Regarding the diversity of the Sudanese population, international screening and diagnosis criteria of glucose intolerance may not apply.

Materials and Methods: This case-control cross-sectional study has recruited pregnant women at Dream Maternity Hospital (n=73) as well as nonpregnant women as control group (n=67). Blood samples were collected from all study units chosen by convenient sampling method and analyzed for blood glucose concentration using spectrophotometry and glucose oxidase-peroxidase kits. Results obtained were analyzed using SPSS (ANOVA).

Results: Mean age in the pregnant women group was 29.8 years and in the control group was 25.4 years. 30.1% of the pregnant women were in their first trimester, 37% in their second trimester and 32.9% in their third trimester. Regarding body mass index in pregnant and control groups (BMI), it ranged 17.2-42.4Kg/m^2(mean 27.04kg/m^2) According to the classification of Gray DS and Fujioka K (1991), 2 women (1.4%) were underweight (BMI <18.5 Kg/m^2), 48(34.3%) were in the normal range (BMI18.5-24.9Kg/m^2) 49(35%) were overweight (BMI25-29.9Kg/m^2), 32 (22.9%) were class 1 obese (BMI 30-34.9Kg/m^2), 7(5%) were class 2 obese (BMI35-39.9Kg/m^2) and 2 (1.4%) were class3 obese (BMI≥ 40Kg/m^2).

No significant difference was noted when blood glucose levels were compared in both groups (p=0.502).

Conclusion: BMI does not affect glucose tolerance in Sudanese pregnant women.

Keywords: Khartoum, women, Dream Maternity Hospital, BMI

Introduction

GDM is defined as carbohydrate intolerance of variable severity with onset or first diagnosed during pregnancy [1]. The definition applies whether insulin or only diet modifications are used for treatment or whether the condition persists after pregnancy or not [2]. Women with increased BMI, age, weight and positive family history of diabetes mellitus should be screened early in pregnancy [3]. Women with GDM have a 10-fold higher risk of developing type 2 diabetes during a 10 years' follow up period compared to women without GDM [4].

In Sudan, one study has concluded that the frequencies of GDM and glucose intolerance in Sudanese pregnant women are within the universal estimates [5]. Another study has concluded that one of the strongest predictors of GDM in Sudanese women is family history of diabetes mellitus [6]. These findings necessitate screening of pregnant Sudanese women for GDM.

There is no international consensus regarding timing and screening methods, although WHO criteria are universally accepted including fasting plasma glucose ≥ 7.0 mmol/L (126mg/dL), 2-hours after a 75 g oral glucose load plasma glucose ≥ 11.1 mmol/L (200 mg/dl) or random plasma glucose ≥ 11.1 mmol/L (200 mg/dl) in the presence of diabetes symptoms [7,8]. However, keeping in mind the diversity of the Sudanese population, judging the international criteria for screening and diagnosis of GDM may not be conclusive.

Objective

This study was designed to explore the effect of BMI on blood glucose levels in Sudanese pregnant women.

Materials and methods

Study design

This is a case- control cross-sectional study that is facility based. Study units were Sudanese pregnant women from Dream Maternity Hospital. Women who are diabetic or are using drugs for any other cause were excluded. Approval of the study was sought from both: College of Medicine, University of Bahri and Ministry of Health, Khartoum State. Volunteer consent was obtained from targeted subjects and they were insured confidentiality and their right to receive treatment even if they did not agree to participate.

Sampling

The number of subjects required for this study was calculated using Cochran's size formula.

$$N= Z^2pq/e^2$$

Where

N= required number of sample units
Z= 1.96
P= estimated proportion of the population that has the attribute in question= 0.95
q= 1-p= 0.05
e= margin of error = 0.05

Using this formula, N was found to be equal to 72.99. Accordingly, 73 subjects were chosen for this study. Convenient sampling method was used to choose the study units since the target population is ill-defined [9].

Materials

Blood samples were collected in Na F containers from73 pregnant women at Dream Maternity Hospital after consent as well as from 67 volunteer nonpregnant ones. Glucose oxidase-peroxidase kits were purchased from Biosystem, Costa Prava, Barcelona, Spain.

Method

Spectrophotometry was used for the assessment of plasma glucose concentration in all the samples. The technique compares light absorbance by the treated samples to that of a standard solution with known glucose concentration (100 mg\dl) [10].

10 microlitres of the standard solution were pipetted into a labeled test tube. 10 microlitres of all samples were also pipetted into labeled test tubes. 1ml of the reagent solution (containing phosphate, phenol, glucose oxidase, peroxidase and 4aminoantipyrine) was added to all tubes as well as to an empty tube containing neither sample nor standard that served as blank. All tubes were thoroughly mixed and were then incubated for 10 minutes at room temperature. The absorbencies of the samples and the standard were measured at 500nm against the blank. Glucose concentrations of the samples were then estimated using the following formula.

$$sample\ glucose\ concentration = \frac{absorbance\ of\ sample}{absorbance\ of\ standard} \times concentration\ of\ standard$$

Results

Pregnant women included in this study were in the age range 19-40 years (mean 29.8 years) while those in the control group aged 18-48 years (mean 25.4 years). Among the pregnant women, 22 were in their first trimester (30.1%), 27 in their second trimester (37%) and 24 in their third trimester (32.9%). Computer programs (Statistical Package for Social Sciences, SPSS) were used to analyze the results obtained through analysis of variance.

Regarding body mass index in pregnant and control groups (BMI), it ranged 17.2-42.4Kg/m^2 (mean 27.04kg/m^2) according to the classification of Gray DS and Fujioka K (1991) [11], 2 women (1.4%) were underweight (BMI<18.5 Kg/m^2), 48(34.3%) were in the normal range (BMI18.5-24.9Kg/m^2) 49(35%) were overweight (BMI25-29.9Kg/m^2), 32 (22.9%) were class 1 obese (BMI 30-34.9Kg/m^2), 7(5%) were class 2 obese (BMI35-39.9Kg/m^2) and 2 (1.4%) were class3 obese (BMI≥ 40Kg/m^2). When BMI was regarded in the comparison of blood glucose levels in both pregnant and control groups no significance was noted (P= 0.502, Tables1, 2 and 3).

Table 1: Comparison of Blood Glucose Levels in Pregnant Women Regarding Body Mass Index (BMI) Dream Maternity Hospital, April, 2017

BMI Class	Number	Mean Blood Glucose (mg/dl)
Underweight	0	0.0
Normal	20	105.3
Overweight	26	103.4
Class 1 obesity	19	105.4
Class 2 obesity	6	95.8
Class 3 obesity	2	103.4

Test: ANOVA **P**=0.792

Table 2: Comparison of Blood Glucose Levels in Non-Pregnant Women Regarding Body Mass Index (BMI) Dream Maternity Hospital, April, 2017

BMI Class	Number	Mean Blood Glucose (mg/dl)
Underweight	2	106.5
Normal	28	101.7
Overweight	23	98.9
Class 1 obesity	13	102.4
Class 2 obesity	1	98.0
Class 3 obesity	0	0.0

Test: ANOVA **P**=0.908

Table 3: Comparison of Blood Glucose Levels in Both Groups Regarding Body Mass Index (BMI) Dream Maternity Hospital, April, 2017

BMI Class	Number	Mean Blood Glucose (mg/dl)
Underweight	2	85.5
Normal	48	102.5
Overweight	49	102.2
Class 1 obesity	32	102.6
Class 2 obesity	7	98.4
Class 3 obesity	2	120.5

Discussion

Pregnancy can be associated with many metabolic, biochemical, physiological and immunological changes which are reversible after delivery. One of these changes is resistance to the action of insulin on glucose uptake and utilization [12].

In this study, when control and pregnant groups were compared regarding body mass index (BMI), no significant difference in blood glucose concentrations were noted. By contrast, Susan Y.Chu *et al.* (2007) [13] who have compared normal pregnant women to those with gestational diabetes concluded that high maternal weight is substantially associated with higher risk for gestational diabetes, as was also the case with Rhadia Khan, Khurshid Ali and Zakkia Khan (2013) [14]. Juhong Leng *et al.* (2015) [15] have shown that maternal overweight is associated with high blood glucose concentration and high risk for gestational diabetes. Other studies have shown that insulin resistance is significant

in obese women with gestational diabetes compared to normal pregnant women [16].

A possible explanation for these differences may consist in the genetic variation for the adiponectin gene [17] Racial attributes may also account for these differences, as it was found that gestational diabetes and BMI were the strongest independent determinants of the results of Oral Glucose Tolerance Test (OGTT) in Asian women when compared to Caucasian ones [18].

Conclusion

We have concluded that BMI does not affect glucose tolerance in Sudanese pregnant women further research is required to explore the genetic and racial basis in this attribute.

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