ORIGINAL ARTICLE

SERUM ADIPONECTIN LEVELS IN PREGNANT WOMEN WITH GESTATIONAL DIABETES MELLITUS IN ZARIA, NORTH WEST NIGERIA: A CROSS SECTIONAL STUDY

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ABSTRACT

Background: Adiponectin is an adipocytokine that is exclusively produced by adipocytes with potent insulin-sensitizing property. It has been proposed to be involved in the pathogenesis of gestational diabetes mellitus, but its role is not clear; Findings from studies done across different ethnic groups are often inconsistent.

Objectives: The aim of the study was to compare maternal serum adiponectin levels between Nigerian pregnant women with and without gestational diabetes mellitus.

Materials And Methods: A cross sectional analytical study including one hundred and sixty nine pregnant women, 85 with gestational diabetes mellitus and 84 with normal gestation, who were evaluated between 24-28 weeks gestation. Diagnosis of gestational diabetes mellitus was made according to the WHO diagnostic criteria. Maternal serum level of adiponectin was measured and compared between pregnant women with gestational diabetes mellitus and the controls.

Results: Mean maternal serum adiponectin level was significantly lower in pregnant women with gestational diabetes mellitus than in the controls (8.1 ± 1.6 vs. 10.1 ± 2.4 µg/ml, $p < 0.05$). When subjects in the study groups were further categorized in to BMI < 25kg/m^2 and BMI 25 kg/m^2, maternal serum adiponectin level remained significantly lower in the normal weight pregnant women with gestational diabetes compared to their BMI-matched controls (8.4 ± 1.7 vs. 11.4 ± 2.1 µg/ml, $p < 0.05$). Among the overweight pregnant women (BMI 25 kg/m^2) on the other hand, there was no difference in maternal serum adiponectin level between pregnant women with gestational diabetes mellitus and the normal controls (7.8 ± 1.5 vs. 8.0 ± 1.1µg/ml, $p > 0.05$).

Conclusion: It is concluded that normal weight Nigerian pregnant women with gestational diabetes mellitus in this study have lower serum adiponectin level compared to the normal weight pregnant women with normal gestation.

KEYWORDS: Gestational, Diabetes mellitus, Adiponectin, Nigerian Women

INTRODUCTION

Gestational diabetes mellitus (GDM), is defined as impaired glucose tolerance with onset or first recognition during pregnancy.[1] It is one of the most common pregnancy complications and affects approximately 3.4% – 13.9% of all pregnancies in Nigeria.[3-7] GDM is associated with various adverse outcomes on pregnant women and their offspring, such as developmental anomalies, macrosomia, shoulder dystocia, maternal trauma, prematurity, hypoglycaemia, jaundice, perinatal morbidity and death, preeclampsia/eclampsia and increased rate of delivery by caesarean section.[2] GDM develops when the maternal insulin supply is insufficient to compensate for the increased insulin resistance during pregnancy,leading to hyperglycaemia by which GDM is defined.[8] The detailed mechanism of how GDM happens

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is not yet completely clear, but more recently many studies, have investigated the connection between maternal serum levels of adiponectin and development of gestational diabetes mellitus. However, reports are inconsistent or even conflicting especially across different ethnic groups.[2,8-17] To our knowledge, no study was done on the relationship between maternal serum levels of adiponectin and development of GDM among Nigerian pregnant women.

Therefore, our objective in this study was to compare maternal serum adiponectin levels between Nigerian pregnant women with and without GDM.

MATERIALS AND METHODS

This is a cross sectional analytical study conducted with 85 pregnant women with GDM and 84 controls (pregnant women with normal gestation) at 24-28 weeks gestation. The diagnosis of GDM was made according to the WHO criteria (Two-hour 75g Oral Glucose Tolerance Tests: Fasting serum glucose 7.0mmol/L or 2-hour post load serum glucose 7.8mmol/L).[18]They were all recruited from pregnant women who attended antenatal clinic of Hajiya Gambo Sawaba General Hospital Zaria, Kaduna State from May 2014 to June 2015. A total of 714 pregnant women were screened for GDM during the study period. All study subjects were Nigerians of African descent. Written informed consent was obtained from each subject, before recruitment in to the study. The study was approved by the Health Research Ethics Committee of Kaduna State Ministry of Health, Kaduna. Pregnant women with history of hypertension, pre gestational diabetes mellitus, multiple gestations, or any pre-existing illness were excluded from the study.

Information including maternal age, parity, gestational age and anthropometric measures were all obtained from the subjects at the time of enrolment. Gestational age was based on the report of ultrasound scan. Weight was taken with only undergarments and rounded to the nearest kilogram. Height was taken with subjects standing erect without shoes and rounded to the nearest centimetre. Body mass index (BMI) was calculated as the ratio of weight in kilogram to square of height in meters and expressed as kg/m^2. The subjects were instructed to be on their normal diet 3 days prior to the oral glucose tolerance tests (OGTT), and then fasted for 10-12 hours (overnight) prior to the OGTT procedure. A fasting blood sample was taken for measurement of fasting serum glucose and adiponectin. The subjects were then given a 75g dose of glucose (in 300ml glass of water) orally over 5-10 minutes. Blood sample was taken at 2 hours post glucose dose for measurement of 2-hour serum glucose.

Biochemical analyses

Serum glucose was measured using an enzymatic glucose oxidase method (Labkit France). Serum adiponectin was assayed using human adiponectin ELISA kit (Wkea Med Supplies Corp. China). All the samples were assayed at the Department of Chemical Pathology, Ahmadu Bello University Teaching Hospital, Zaria.

Statistical analysis

Statistical Package for the Social Sciences (SPSS) version 20.0 was used for statistical analysis. Data are presented using measures of central tendency and dispersion. We compared mean differences of serum adiponectin level between groups using t-test. Kolmogorow-Smirnov test was used to test for normality of distribution of data. All p-values were 2-sided and considered significant if less than 0.05

RESULTS

Clinical characteristics of the study participants are summarized in Table 1. Both the pregnant women with GDM and the controls have similar ages of 26.0 ± 6.0 vs. 27.0 ± 5.0 years respectively ($p > 0.05$). Gestational age and parity also did not differ significantly between pregnant women with GDM and the normal controls (26.0 ± 1.0 vs. 26.7 ± 1.0 weeks,

p> 0.05) and(2.3 ± 1.6 vs. 2.7 ± 1.7, p >0.05) respectively. In comparison with the controls, pregnant women with GDM showed significantly greater pregnancy BMI (25.4 ± 4.0 vs. 23.4 ± 3.8 kg/m^2, p< 0.05). Biochemical parameters of the study participants are shown in Table 2. Fasting serum glucose did not differ significantly between the pregnant women with GDM and the controls (4.3 ± 0.6 vs. 4.3 ± 0.7 mmol/L, p> 0.05). But pregnant women with GDM had significantly higher post load glucose values compared with those in the controls (9.0 ± 0.9 vs. 6.3 ± 0.8 mmol/L, p < 0.05). Serum adiponectin level was significantly lower among the pregnant women with GDM compared to the controls (8.1 ± 1.6 vs. 10.1 ± 2.4 µg/ml, p< 0.05).

When subjects in the study groups were further categorized in to BMI < 25kg/m^2 and BMI 25 kg/m^2 (Table 3), it was found that among the normal weight pregnant women (BMI < 25 kg/m^2), serum adiponectin level remained significantly lower in those with GDM when compared to their BMI-matched controls (8.4 ± 1.7 vs. 11.4 ± 2.1 µg/ml, p< 0.05). In the overweight pregnant women (BMI 25 kg/m^2) on the other hand, there was no difference in serum adiponectin level between

Table1: Clinical characteristics of the study participants

	GDM(m ± SD)	Controls(m ± SD)	*p*-value
Sample size (n)	85	84	
Age (years)	26.0 ± 6.0	27.0 ± 5.0	0.040
Parity	2.3 ± 1.6	2.7 ± 1.7	0.106
Gestational age (weeks)	26.0 ± 1.0	25.8 ± 1.0	0.196
Weight (kg)	65.0 ± 15.0	62.0 ± 14.0	0.124
Height (cm)	159 ± 8.0	161 ± 7.0	0.069
Body Mass Index BMI (kg/m^2)	25.4 ± 4.0	23.4 ± 3.8	0.020
Systolic blood pressure (mmHg)	117 ± 8	118 ± 5	0.139
Diastolic blood pressure (mmHg)	78 ± 5	79 ± 3	0.296

m, Mean SD, standard deviation GDM, gestational diabetes mellitus

Table 2: Biochemical profiles of the study participants

	GDM(m ± SD)	Controls(m ± SD)	*p*-value
Sample size(n)	85	84	
OGTT			
Fasting serum glucose(mmol/L)	4.3 ± 0.6	4.3 ± 0.7	0.439
2 hour serum glucose(mmol/L)	9.0 ± 0.9	6.3 ± 0.8	0.000
Serum Adiponectin(µg/ml)	8.1 ± 1.6	10.1 ± 2.4	0.000

m, Mean SD, standard deviation OGTT, oral glucose tolerance test GDM, gestational diabetes mellitus

Table 3: Biochemical profiles of the study participants in relation to body mass index

	GDM(m ± SD)	Controls(m ± SD)	*p*-value
BMI <25kg/m^2	39	53	
Fasting serum glucose (mmol/L)	4.2 ± 0.7	4.1 ± 0.7	Ns
2 hour serum glucose (mmol/L)	8.9 ± 0.9	6.2 ± 0.8	0.000
Adiponectin (µg/ml)	8.4 ± 1.7	11.4 ± 2.1	0.000
BMI 25kg/m^2	46	31	
Fasting serum glucose (mmol/L)	4.5 ± 0.6	4.5 ± 0.7	Ns
2 hour serum glucose (mmol/L)	9.1 ± 0.8	6.3 ± 0.8	0.000
Adiponectin (µg/ml)	7.8 ± 1.5	8.0 ± 1.1	Ns

m, Mean SD, standard deviation BMI, body mass index Ns, not significant GDM, gestational diabetes mellitus

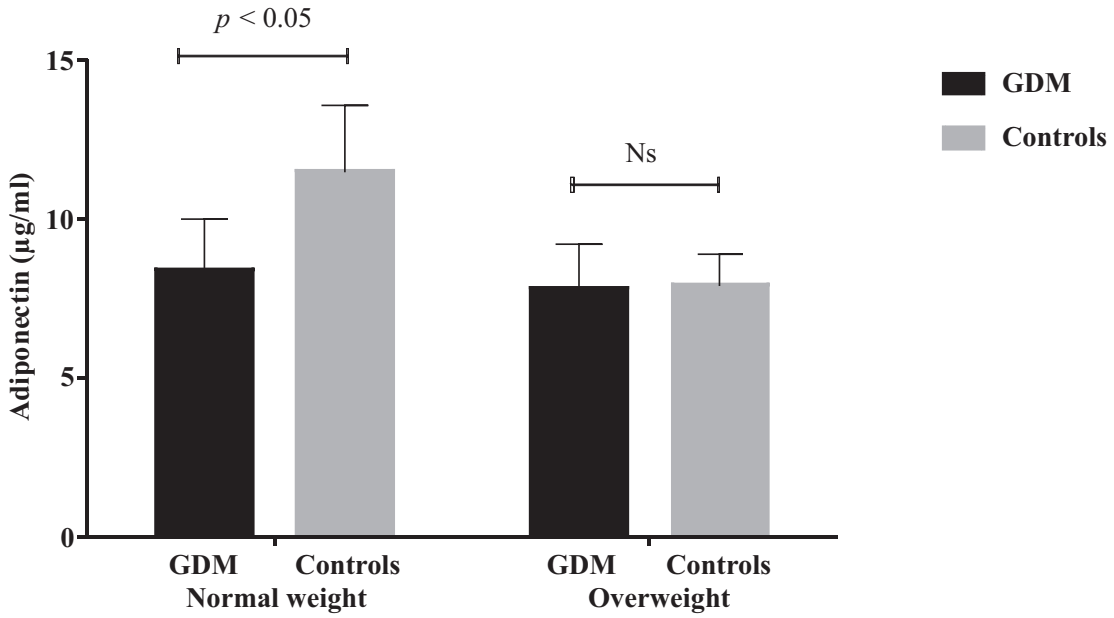

Figure 1. Serum adiponectin levels among normal weight and overweight GDM subjects and controls.

Mean ± standard deviation are shown
Ns, Not significant
GDM, gestational diabetes mellitus

DISCUSSION

This study has shown that pregnant women with GDM have lower maternal serum adiponectin level than the normal controls. This finding of lower serum adiponectin in pregnant women with GDM has been reported in many previous studies.[9-15] Also in support of the results of this study Lacroix *et al.* showed that lower maternal serum adiponectin levels are associated with higher risk of developing GDM.[2]

The lower maternal circulating adiponectin level remained significant in normal weight pregnant women with GDM compared to the normal weight control subjects. However, this significant difference was lost in the overweight subjects, as there was no observed difference in adiponectin levels between the overweight pregnant women with GDM and the overweight controls. The same finding was reported by Ranheim *et al.*,[11] although in a study with a relatively smaller sample size (22 GDM and 29 controls).

However, the findings of McLachlan *et al*. did not show significant difference between adiponectin levels in pregnant women with GDM compared to normal controls. Their negative findings might be explained by the limited sample size (19 GDM and 19 control subjects) and the relatively older study subjects (mean age of 33 years for both the women with GDM and the controls).[16] Adding to the controversy, Saucedo *et al.*, in a study involving 60 pregnant women with GDM and 60 pregnant women with normal glucose tolerance (controls), also found the maternal circulating adiponectin levels to be similar in both groups.[17] The discrepancy in this case may be due to the greater BMI of their study subjects (mean BMI of 30kg/m^2 and 28kg/m^2 for the pregnant women with GDM and the control groups respectively).

GDM is characterized by an amplification of low grade inflammation, already existing in normal pregnancy and increased circulating levels of inflammatory cytokines including the TNF-, whose production from maternal adipose tissue is enhanced by placental production. TNF- is a negative regulatory factor of adiponectin gene. Thus, the higher level of TNF- suppresses the transcription of adiponectin gene in adipocytes, and this might explain the lower levels of adiponectin in pregnant women with GDM.

CONCLUSION

We conclude that among the normal weight pregnant women in this study, those with GDM have lower maternal serum adiponectin level than the pregnant women with normal gestation. However, larger prospective studies are required that would examine the mechanism of alteration of this cytokine and its pattern from first through third trimester in pregnant women with GDM within the population.

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