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HYPERGLYCAEMIC PROFILE OF PREGNANT WOMEN ATTENDING ANTENATAL CLINIC IN JOS METROPOLIS

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ABSTRACT

Background: Hyperglycaemia remains one of the world deadliest diseases affecting both pregnant and non-pregnant women thus attesting to the fact that the vulnerable group (i.e. women) and the girl child in the 3rd world countries appear to be perpetually hopeless. The aim of the study was to determine the plasma glucose profile in selected pregnant women attending antenatal clinics in two selected Hospitals in Jos metropolis of Plateau State, Nigeria. **Methods:** This was a retrospective study in which 120 subjects were recruited from a Teaching and a Private Hospital in Jos metropolis. They were grouped into two - group 1 (non-pregnant/control) and group 2 (pregnant) which were further subdivided according to 1st, 2nd and 3rd trimesters with 30 women in each. Fasting blood sugar (FBS) (mmol/L) and body weight (kg) were determined. **Result:** Mean plasma glucose level in non-pregnant women was 4.0mmol/L, while that of pregnant women was 3.0mmol/L in the first trimester, 3.7mmol/L in the second trimester and 3.6mmol/L in the third trimester respectively. There was a significant change in plasma glucose $t=3.19$ in pregnant women $p<0.05$ as compared to control. Also significant change was observed in pregnant women $t=4.72$ in their first trimester $p<0.05$. However, there was no difference in glucose level in 2nd and 3rd trimester respectively $p>0.05$ as compared with control. **Conclusion:** There was a significant change in plasma glucose during pregnancy. Routine blood glucose screening should however be upheld for pregnant women in order to ascertain diabetes–induced pregnancy.

KEYWORDS: Hyperglycemia, Pregnancy, Trimester, Jos, Nigeria.

INTRODUCTION

The vulnerable group in the society have continued to suffer in the under developed and developing nations. Their struggle for survival in what looks as if "chocking" society has made women, the girl child, children and aged to remain in the vulnerable group in the world even today despite the various evolution of the society. Hyperglycaemia remains one of the world deadliest diseases affecting both pregnant and non-pregnant women. As ongoing epidemics of obesity and diabetes resulted in more type 2 diabetes in young women, the numbers which were undiagnosed before pregnancy started increasing.[1] Examination and evaluation of pregnant women for hyperglycemia needs urgent attention, as the accompanying complication poses a great risk to both the mother and the neonate irrespective of the period during pregnancy.

Gestational diabetes mellitus (GDM) is a topic of considerable controversy. It is so especially when it comes to its screening and diagnosis and at times even to justify interventions for its management and their cost-effectiveness adds to the controversy. It is more controversial whether maternal hyperglycemias less severe than that in diabetes mellitus are associated with increased risks of adverse pregnancy outcomes.[2] Among non-white women, the risk of GDM with a 1 h glucose value equaling or greater than 200mg/dL is greater than 90%.[3] Gestational Diabetes Mellitus (GDM) is diagnosed during pregnancy and can lead to pregnancy complications as poorly controlled diabetes increases the risk of- Preeclampsia, early delivery, cesarean birth, having a big baby, which can complicate delivery, having a baby born with low blood sugar, breathing problems, and jaundice.[4]

In women with type 1diabetes, extreme growth of the fetus starts early in pregnancy and is likely caused by increased maternal glucose levels. Further investigation is needed to see whether early tight glycemic control will reduce the number of extreme Large-for-gestational-age (LGA) infants.[5] Pregnancy complications are health problems that occur during pregnancy. This may involve the mother and the baby's health or both. Some women have health problems that arise during or prior to pregnancy that often lead to complications. Managing gestational diabetes, by following a treatment plan outlined by a health care provider, is the best way to reduce or prevent problems associated with high blood sugar during pregnancy. If not controlled, it can lead to high blood pressure from preeclampsia and having a large infant, which increases the risk for cesarean delivery.[6] It is imperative for women to receive adequate health care before and during pregnancy to reduce the risk of pregnancy complications. High blood glucose level may indicate a disease condition or metabolic abnormalities such as excessive food intake, insufficient amount of insulin, impaired fasting blood glucose (110mgldL-26mg/dL), diabetes mellitus (higher than 126mgldL), pancreatic cancer, acromegaly, Cushing's syndrome, hypothyroidism or injection of too much insulin.[7] The incidences of macrosomia may be reduced by tighter control of diabetes at conception and during the first trimester, while two others studies show that second and third trimester glucose values are related to neonatal morbidity.[8] In women with type 1 diabetes, extreme growth of the fetus starts early in pregnancy and is likely caused by increased maternal glucose levels.[9] The birth of large-for-gestational-age (LGA) infants (birth weight $\geq 90^{th}$ centile) is the most frequent of the complications seen in pregnancies of women with type 1 diabetes.[10-13] An obstacle in the existing studies is that glycemic control was expressed as the mean of six to eight self-monitored blood glucose levels a day. It is not likely that the mean of six to eight self-monitored glucose levels a day truly reflects the diurnal glucose profile [14]. Fetal macrosomia is associated with short-term complications such as increased rates of caesarean section, shoulder dystocia, and neonatal hypoglycemia.[15] The Continuous Glucose Monitoring System (CGMS) overcomes these problems, and in pregnant women with type 1 diabetes, it has been shown that glucose levels measured with this device closely resemble maternal plasma glucose values.[16] First-trimester screening by fasting glucose level also offers the opportunity to detect and treat undiagnosed pregestation diabetes, which becomes a major problem as the prevalence of diabetes increases rapidly. Otherwise, these high-risk women would not receive any special treatment until the beginning of the third trimester. Also, unrecognized and untreated pregestational diabetes has increased risk for congenital malformations, intrauterine fetal deaths, etc that would not get appropriate attention if the diagnosis was not made in early pregnancy.[17] In pregnant women, similar to the non-pregnant state, fasting plasma glucose >125mg/dl is considered diagnostic for diabetes. Also in non-pregnant adults, impaired fasting glucose is diagnosed with fasting glucose levels of 100-125 mg/dl.[18] Detection of women at higher risk for adverse pregnancy outcomes early in pregnancy is a desirable goal because interventions such as diet, medication, and exercise may be applied earlier and have a positive effect on maternal and fetal outcomes.[19-20]

Maternal AIC levels, which are an expression of mean glucose levels over the past 6-8 weeks, are not or are poorly related to infant birth weight (centiles) and generally explain <10% of the variance in birth weight.[21] In this study, AIC levels during the first and second trimesters of pregnancy were not significantly related to infant birth weight. Third trimester AIC levels were significantly but weakly related to infant birth weight ($p=0.571$) and therefore cannot entirely explain the variance in infant birth weight. Fasting glucose levels, in combination with maternal weight, have been shown to explain only 12% of variance in birth weight, while mean postprandial blood glucose level throughout pregnancy have been shown to explain about 40% of the variance in birth weight.[22] This suggests that postprandial glycemia rather than basal or mean glycemia influences fetal growth and size at birth. Recently, it has been shown that AIC levels do not correlate well with 24-h glucose profiles as measured with the CGMS.[23]

METHODS

A total of 120 subjects (age range of 20-35 years) 90 of which were attending antenatal clinics were recruited from two selected private Hospital in Jos metropolis. These were grouped into two-group 1 (non-pregnant/ control) and group 2 (pregnant) which were further subdivided according to 1^{st}, 2^{nd} and 3^{rd} trimester with 30 women in each. Fasting blood glucose sampling was used to screen the pregnant population at booking.

Survey Technique and Sample Collection

3mls of blood was collected from fasted subject via venipuncture between 8-10am. Blood samples was put inside fluoride oxalate bottle and centrifuged. The plasma was separated into labeled tubes with stopper. These were kept frozen until assayed. Estimation of plasma glucose was carried out using glucose oxidase method. 2ml of blood was collected from each subject via venipuncture into the fluoride tube and mixed. The plasma harvested was used for the determination of glucose by glucose oxidase method in which the glucose oxidase coverts β – D – glucose in the presence of atmospheric oxygen to yield glucoric acid and hydrogen peroxide. Horse reddish peroxidase was used to catalyze the second reaction while hydrogen peroxide is used to oxidize a dye compound – chroogen. The shift in absorbance was monitored spectrophotometrically and is and is proportional to the amount of glucose present in the specimen.

Colorimeter (ICM model 211505/N9201373) U.S.A, All reagents were manufactured by British drug House chemical limited poole England), D-glucose-(May and Baker) Hughs and highs ltd.

RESULTS AND DISCUSSION

Table 1: Distribution of women FBS across Age, and Weight.

Non-pregnant women (control)			Pregnant Women								
			1st Trimester			2nd Trimester			3rd Trimester		
Age (yrs)	Weight (kg)	FBS Mmol/L	Age (yrs)	Weight (kg)	FBS Mmol/L	Age (yrs)	Weight (kg)	FBS Mmol/L	Age (yrs)	Weight (kg)	FBS Mmol/L
20	48	5.4	21	65	4.2	24	62	4.1	24	64	3.9
22	50	5.0	24	57	4.2	24	68	4.8	30	70	3.9
24	56	4.8	26	55	5.8	30	70	3.2	30	822	3.8
24	57	4.8	24	51	2.0	30	75	2.9	26	56	3.9
23	55	3.0	25	82	3.0	20	62	4.0	28	100	3.8
27	60	3.3	28	86	3.6	20	60	4.2	28	83	3.7
27	56	4.0	27	67	3.0	2	62	4.0	24	70	3.6
26	57	4.0	28	61	2.2	20	63	4.4	20	75	3.8
26	60	3.8	29	70	5.6	22	62	4.3	20	82	3.9
26	52	3.6	35	74	2.2	24	65	2.2	25	64	3.8
28	65	3.3	30	74	3.4	23	60	3.2	26	62	3.0
28	62	3.0	31	70	2.1	30	65	2.4	28	64	3.4
29	63	4.0	32	86	2.0	30	70	2.7	32	62	3.0
30	70	3.2	25	71	4.0	24	75	2.9	34	60	3.4
32	60	3.3	27	69	3.6	20	62	4.0	34	60	3.0
33	61	3.9	28	69	3.0	20	50	4.2	35	67	3.0
35	62	3.9	26	69	3.3	31	63	4.7	35	68	3.0
35	62	4.0	29	57	3.3	31	65	4.7	26	68	3.4
28	57	3.3	30	56	2.2	31	70	4.6	26	70	3.4
29	58	3.8	20	56	2.3	26	60	3.0	28	82	3.3
24	59	4.9	22	60	2.1	27	61	3.1	27	82	4.2
24	60	4.2	24	60	2.0	24	62	3.3	27	8	4.0
23	62	3.9	29	60	2.2	25	70	3.6	27	74	4.1
25	61	4.8	23	62	3.2	27	68	3.2	20	68	4.9
27	63	3.9	25	58	3.2	27	80	3.6	24	79	8.0
27	60	3.6	27	62	3.3	29	62	3.1	24	86	2.7
28	62	4.0	32	65	3.0	28	58	5.0	22	59	2.2
30	58	3.8	30	65	3.0	32	64	5.1	25	69	2.4
30	68	4.9	33	70	3.2	33	62	5.8	25	82	2.2
30	61	3.8	34	71	2.2	29	75	2.9	24	70	2.3

Table 2: Mean and Standard Deviation of Plasma Glucose Level and Weight.

Parameter	Control (Non-Pregnant Women)		Pregnant Women					
			1st Trimester		2nd Trimester		3rd Trimester	
Plasma Glucose	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Mmol/l	4.0	0.62	3.0	0.98	3.7	0.62	3.6	1.05
Weight (Kg)	59.5	4.64	65.0	8.80	65.9	6.13	72	10.1
Number of Subjects	30		30		30		30	

Table 3: Means Comparison of Plasma Glucose Levels of Control Various Trimester.

Group	t value	P	Remark
Control vs Pregnancy	3.19	<0.05	Significant
Control vs Pregnancy	4.72	<0.05	Significant
Control vs 2nd	1.46	>0.05	Non significant
Control vs 3rd	1.80	>0.05	Non significant
1st vs 2nd	2.82	<0.05	Significant
1st vs 3rd	2.29	<0.05	Significant
2nd vs 3rd	0.39	>0.05	Non significant

Table 4: Means Comparison of Weight of the Various Trimesters.

Group	T	P	Remark
1st vs 2nd	0.46	>0.05	Insignificant
1st vs 3rd	-2.49	<0.05	Significant
2nd vs 3rd	-3.25	<0.05	significant

Results showed that the mean value for control was 4.0 mmol/L while that of pregnant women was 3.0, 3.7 and 3.6 mmol/L at first, second and third trimesters respectively. The mean weight value (kg) for control was 59.5 kg while that of pregnant women was 65, 65.9, 72kg at first, second and third trimesters respectively (Table 2). There was significant variation (P<0.5) between control and first trimester, first and second as well as first and third trimesters' plasma glucose level (Table 3). There was also significant difference (P<0.5) in weight between the first and third as well as the second and third trimesters (Table 4). Our study reported low fasting plasma glucose level among the pregnant population when compared to the non-pregnant (control) group. The significant changes in plasma glucose level (t=4.72 P<0.5) between the first trimester and the other trimesters could be attributed to increased peripheral utilization of glucose. This finding is in consistent with Riskin-Mashiah *et al.* (2011), who asserted that fasting glucose levels decrease early in pregnancy with only slight further decrease later on. It seems that the same fasting glucose cut-off can be used throughout pregnancy for the diagnosis of gestational diabetes mellitus.[24] It could also be attributed to enhanced insulin sensitivity in early gestation as opposed to decrease insulin sensitivity as pregnancy progresses as a result of the production of human placental lactose. A look into the weight profile of the various trimesters showed mean weights of 56 ± 8.80kg, 65.9 ± 6.13kg and 72 ± 10.1 kg respectively (Table 4) thus an expected weight gain profile which could have augmented insulin unresponsiveness.

Furthermore, body weight is linear to the stage of pregnancy as increase in glucose level in the 2nd and 3rd trimesters as compared to the first trimester could be attributed to increase in mother's weight; which occurs as a combination of body weight and increase in mother's plasma volume. Recent data from the Hyperglycemia and Adverse Pregnancy Outcomes (HAPO) study suggested that concentrations of maternal glucose below the previously accepted diagnostic thresholds for gestational diabetes are predictive of LGA and fetal hyperinsulinemia thus the need for routine blood glucose screening during pregnancy.[25]

CONCLUSION AND RECOMMENDATION

This study showed that there was a significant change in plasma glucose during pregnancy. Routine blood glucose screening should however be upheld for pregnant women in order to ascertain diabetes–induced pregnancy. This could be achieved via the antenatal routine screening assay for pregnant women.

ETHICAL ISSUES

This was obtained from the ethical and research committee of the Jos University Teaching Hospital, Jos Nigeria.

CONFLICT OF INTEREST

None.

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