

## Assessment of the Levels of Fasting Blood Sugar, Hemoglobin, Proteinuria and Blood Pressure in Pregnant Women in Nnewi, Anambra State, Southeast Nigeria

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**Abstract:** Pregnancy is characterized by a great number of metabolic physiological changes. The present study was designed to assess the levels of fasting blood sugar (FBS), hemoglobin (Hb), proteinuria, systolic blood pressure (SBP) and diastolic blood pressure (DBP) in pregnant women in Nnewi, Anambra State, Nigeria. A total of 100 participants aged between 18 and 36 ( $22.5 \pm 3.5$ ) years were randomly recruited for the study. The participants were grouped as follows: 50 pregnant women and 50 non pregnant women. Thereafter, 5mls each of blood samples were collected from the participants into fluoride oxalate and EDTA containers for the determination of fasting blood sugar and hemoglobin levels respectively using standard method. Urine samples were also collected for urinalysis while the SBP and DBP of the subjects was measured using sphygmomanometer. The result showed that the mean FBS level was significantly lower in pregnant women compared to the control group ( $p < 0.05$ ), while proteinuria, SBP, and DBP were significantly higher in pregnant women than in control ( $p < 0.05$ ) respectively. However, the mean Hb level were similar between both groups ( $p > 0.05$ ). Also, FBS level was significantly lower while proteinuria, SBP and DBP were significantly higher in pregnant women with  $\geq 6$  months of pregnancy than those with  $\leq 5$  months of pregnancy respectively ( $p < 0.05$ ). Therefore, the implication of this finding is that the pregnant women had neither gestational diabetes mellitus nor anemia rather pre-eclampsia was predominant among the study population.

**Keywords:** Fasting blood sugar (FBS), Hemoglobin (Hb), Proteinuria, Blood pressure, Pregnant women, Preeclampsia.

## INTRODUCTION

Gestational diabetes mellitus is defined as any degree of glucose intolerance with onset or first recognition during pregnancy [1]. Gestational diabetes can be determined biochemically by using random blood testing in each trimester of pregnancy and by oral glucose tolerance test (OGTT). Also, it can be diagnosed using fasting blood sugar estimation. In Nigeria, fasting blood glucose level is said to be normal when it is between 3.3mmol/L and 5.5mmol/L [2] while the range for Americans and other European Countries is between 3.9mmol/L and 5.5mmol/L [3]. However, when the plasma glucose level is greater than 7 mmol/L, it is considered diabetic.

Anaemia in pregnancy is considered as one of the factors that significantly affect pregnancy and its outcome, and it constitutes the commonest haematological problem in pregnancy [4, 5]. The most

commonly referred to of the haematological indices are the indicators of haemoglobin concentration, and low haemoglobin (anaemia) is the most widely identified haematological abnormality and is associated with adverse pregnancy outcome [6]. Anaemia is a common and serious problem in pregnancy and needs to be addressed [7]. It has been reported to be present when the blood hemoglobin value is below the reference value for the age, sex, and place of residence of the individual [8].

Anemia in pregnancy is defined according to World Health Organisation as hemoglobin concentration of  $< 11$  g/dl [9]. It is estimated that 41.8% of pregnant women are anemic worldwide with the prevalence of anemia in developing countries put at 33%-75% [10-12, 4]. Preeclampsia (PE) is a frequent complication of pregnancy that affects 5%-8% of all gestations [13-16]. It remains a major cause of

maternal and neonatal morbidities and mortality, as more than 50,000 women die annually from preeclampsia worldwide, mostly in developing countries [17-21]. It is characterized by hypertension, proteinuria and edema, usually by the last trimester of pregnancy. Preeclampsia occurs mainly in the women in their first pregnancies or to those who carry twins [22], and is usually diagnosed based on new onset hypertension, proteinuria, or end organ damage after 20 weeks of gestation [17]. Hypertension, diabetes mellitus, proteinuria, obesity, family history, nulliparity, multiple pregnancies, use of contraceptions, older women conception (> 40) and thrombotic vascular disease contribute as the risk factors for preeclampsia [23, 24]. However, the actually pathogenesis of preeclampsia is still unknown. Although many mechanisms have been proposed including angiogenic imbalance [25, 26], endothelial cell dysfunction and exaggerated inflammation [27, 17, 28]. Pre-eclampsia and eclampsia are two hypertensive disorders of pregnancy which are considered as the major causes of maternal and perinatal morbidity and mortality [29].

Hypertension, also known as high blood pressure (HBP) is one the major public health problem that has been of health concern and is a leading cause of morbidity and mortality globally [30]. Hypertension is defined as persistent elevation of systolic BP of 140 mmHg or greater and/or diastolic BP of 90 mmHg or greater. It is a long term medical condition in which the blood pressure in the arteries is persistently elevated [31], and is the most prevalent maternal complication worldwide which affects about 7–10% of all pregnancies [29, 32]. It is estimated that 192 people die every day because of hypertensive disorders in pregnancy [33].

It is the most common medical problem encountered in pregnancy, among the aged and is a leading cause of perinatal and maternal morbidity and mortality [34, 35]. Pregnant women with hypertension are more likely to develop placental abruption, disseminated intravascular coagulation (DIC), cerebral hemorrhage, hepatic failure and acute renal failure [34]. Therefore, the present study is designed to assess the proteinuria, fast blood sugar, hemoglobin systolic blood pressure and diastolic blood pressure levels in pregnant women in Nnewi, Anambra State, Southeast Nigeria.

## **MATERIALS AND METHODS**

### **Research Design and Sample Collection**

This is an experimental study designed to assess the levels of fast blood sugar, hemoglobin, proteinuria, systolic blood pressure and diastolic blood pressure in pregnant women in Nnewi, Anambra State, Southeast Nigeria. A total of 100 participants aged between 18 and 37 years were randomly recruited for

the study. The participants were grouped into two comprising of 50 pregnant women and 50 non pregnant women. The protocol was explained to the subjects and thereafter, 5mls of fasting blood sample each and dispensed in proportion into fluoride oxalate containers and EDTA bottles respectively for the determination of fasting blood sugar and hemoglobin level. Also, the 24hours-urine samples of the subjects were obtained in universal specimen containers and used for the determination of protein level in urine. Thereafter, the participants' blood pressure readings (systolic blood pressure and diastolic blood pressure) were measured using sphygmomanometer and values obtained in duplicate and average reading taken.

### **Inclusion and exclusion criteria**

Apparently healthy Pregnant and non pregnant women aged between 18 and 37 years were included for the study while the study excluded children, women younger than 18 or above 37years, women who were sick and those already on anti-hypertensive drugs.

### **Estimation of fasting blood glucose level**

Fast blood glucose estimation was done using oxidase method as described by Tietz *et al.*, [36].

### **Determination of hemoglobin level**

Hemoglobin level was determined using Mythic 22 automated hematology analyzer.

### **Determination of urinary protein level**

This was done by using Combi 2 test strip to screen for proteinuria in participants' urine samples and thereafter, participants' urinary protein concentrations were quantitatively determined using biuret method as described by Hiller *et al.*, [37].

### **Measurement of blood pressure readings**

This was done using the method described by Chobanian *et al.*, [38].

### **Ethical Consideration**

This was sought and obtained from Faculty of Health Sciences and Technology Ethical Committee, Nnewi. Informed consent was obtained from participants prior the commencement of the study.

### **Statistical analysis**

Data obtained were tabulated and analyzed using SPSS version 20.0 (SPSS Inc. Chicago, IL, USA). Student's t-test was employed in comparing means and results expressed as Mean±SD. P<0.05 was considered statistically significant.

## **RESULTS**

Between group comparison showed that the mean age (years) of pregnant women was significantly higher than in non-pregnant women (p=0.000).

Similarly, the mean fasting blood glucose level (mmol/l) of pregnant women was significantly lower compared to the control group ( $p=0.005$ ), but the mean hemoglobin level (g/dl) was not significantly different when compared between both groups ( $p=0.068$ ). Again, between group comparison showed that the

level of proteinuria (g/l) observed in pregnant women was significantly higher compared to control ( $p=0.000$ ). Also, the mean systolic blood pressure (mmHg) and diastolic blood pressure (mmHg) were significantly higher in pregnant women than in control group ( $p=0.013$  and  $0.000$ ) respectively (see table-1).

**Table-1: comparison of mean ( $\pm$ SD) age, fasting blood glucose, hemoglobin, proteinuria, systolic blood pressure and diastolic blood pressure in pregnant and non pregnant women**

Variables	Pregnant women (n=50)	Non pregnant women (n=50)	t-value	p-value
Age	26.00 $\pm$ 4.79	19.00 $\pm$ 2.04	21.730	0.000*
Fasting blood glucose (mmol/l)	3.89 $\pm$ 0.39	4.25 $\pm$ 0.74	9.010	0.005*
Hemoglobin (g/dl)	11.14 $\pm$ 1.37	12.85 $\pm$ 0.90	3.480	0.068
Proteinuria (g/l)	1.96 $\pm$ 0.70	1.60 $\pm$ 0.50	92.670	0.000*
Systolic blood pressure (mmHg)	126.80 $\pm$ 10.69	115.20 $\pm$ 5.86	6.680	0.013*
Diastolic blood pressure (mmHg)	87.60 $\pm$ 8.31	78.80 $\pm$ 7.81	0.190	0.000*

\*Statistically significant at  $p<0.05$ .

The mean age, FBS as well as Hb levels in pregnant women between 3-5 months of pregnancy did not differ significantly compared with the values obtained in pregnant women between 6-9 months of pregnancy ( $p>0.05$ ) respectively. However, the proteinuria observed in the pregnant women  $\geq 6$  months

of pregnancy as well as mean SBP and DBP levels were significantly higher than in pregnant women  $\leq 5$  months of pregnancy respectively ( $p<0.05$ ) (see table-2).

**Table-2: comparison of mean ( $\pm$ SD) age, fasting blood glucose, hemoglobin, proteinuria, systolic blood pressure and diastolic blood pressure in pregnant between 3-5 and 6-9 months of pregnancy**

Variables	Pregnant women $\leq 5$ month (n=15)	pregnant women $\geq 6$ months (n=35)	t-value	p-value
Age	23.63 $\pm$ 4.96	27.12 $\pm$ 4.41	0.002	0.089
Fasting blood glucose (mmol/l)	3.94 $\pm$ 0.14	3.86 $\pm$ 0.47	15.285	0.675
Hemoglobin (g/dl)	11.55 $\pm$ 0.37	10.95 $\pm$ 1.62	11.728	0.319
Proteinuria (g/l)	1.41 $\pm$ 0.51	2.00 $\pm$ 0.00	228.978	0.004*
Systolic blood pressure (mmHg)	117.50 $\pm$ 4.63	131.18 $\pm$ 9.93	2.784	0.001*
Diastolic blood pressure (mmHg)	81.25 $\pm$ 6.41	90.59 $\pm$ 7.48	0.333	0.006*

\*Statistically significant at  $p<0.05$ .

## DISCUSSION

The present study assessed the levels of fast blood sugar (FBS), hemoglobin (Hb), proteinuria, systolic blood pressure (SBP) and diastolic blood pressure (DBP) in pregnant women in Nnewi, Anambra State, Southeast Nigeria.

In this study, the mean age (years) of the pregnant women were found to be significantly higher compared with the control group ( $p<0.05$ ). Maternal age has been previously reported to have an influence on the incidence of pre-eclampsia and subsequently on mortality [39, 40]. In the present study, the mean maternal age of pregnant women was 26.00 $\pm$ 4.79. This is in consonance with the report of Adeosu *et al.*, who investigated the maternal and neonatal outcomes of pre-eclampsia in African black women in South West Nigeria and found that the maternal age was 25-34 years [41].

In the present study, the mean plasma fast blood glucose level was significantly lower in pregnant

women than in non pregnant women ( $p<0.05$ ). This may imply the absence of gestational diabetes mellitus among the subjects studied. This is in accordance with the findings of previous similar studies [42, 43] and in contrast with the reports of Ekhatior and Ebomoyi [44], and George and Duoboye [45], who had earlier reported higher values of fasting blood glucose levels in pregnant women than in the non pregnant women.

Furthermore, the mean hemoglobin level did not differ significantly between the value obtained in pregnant women and the control group ( $p>0.05$ ). This may suggest that there was no anaemia found among the pregnant women under study. This is in agreement with the findings of Obeagu *et al.*, [46] and Dika *et al.*, [47], whereas, it is in contrast with the report of Michael *et al.*, [48].

However, the present study revealed that the mean level of proteinuria in pregnant women was significantly higher than in the control subjects (1.96 $\pm$ 0.70 Vs 1.60 $\pm$ 0.50;  $p=0.000$ ). The detection of

proteinuria of  $\geq 300$ mg in 24 hours urine of pregnant women is central in the diagnosis of pre-eclampsia [23, 49] and maybe indicative of a renal compromise. Also, pre-eclampsia is associated with increased capillary permeability secondary to endothelial damage and this may be responsible for the observed proteinuria. Our finding is in line with some other previous studies [50, 51, 41, 52].

More so, the mean systolic and diastolic blood pressure observed in this study were significantly elevated in pregnant women compared to control group ( $p > 0.05$ ) respectively. Elevated blood pressure is a hallmark of pre-eclampsia and has been previously reported to have a strong risk for the development of pre-eclampsia [53]. This finding is in consonance with the report of previous studies [51, 54, 55, 41, 52]. The pathophysiology of hypertension may be attributed to the increased peripheral vascular resistance rather than increased cardiac output [56].

However, there were no significant differences observed in the mean levels of FBS and Hb in pregnant women between 3-5 months of pregnancy when compared with values obtained in pregnant women between 6-9 months of pregnancy ( $p > 0.05$ ), whereas the mean proteinuria, SBP and DBP levels were significantly higher in the pregnant women between 6-9 months of pregnancy than in those of between 3-5 months pregnancy ( $p < 0.05$ ). This may indicate that proteinuria and blood pressure in pregnancy increases with increasing stage of gestation.

## CONCLUSION

The present study revealed that proteinuria and high blood pressure were significantly higher while FBS was significantly lower in pregnant women than in control respectively. Also, Hb level did not differ significantly in both groups. This study showed that proteinuria, SBP and DBP were significantly raised and FBS and Hb were not different in pregnant women with  $\geq 6$  months of pregnancy than in those with  $\leq 5$  months of pregnancy respectively. Therefore, the implication of this finding is that the pregnant women had no gestational diabetes mellitus and no anemia rather pre-eclampsia was predominant among the study population.

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