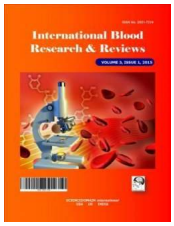

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Changes in Packed Cell Volume and Some Biochemical Parameters of Adult Females during Pregnancy in North-West Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author IM contributed to the concept and design of the study, literature review, data collection, statistical analysis and interpretation, preparation of first and revised edition of manuscript while author ISY contributed to the data collection, literature review and preparation of the first manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

Background: Pregnancy is associated with changes in woman's renal function, carbohydrate and protein metabolism and particularly hormonal pattern. The objective of this study was to determine the values of packed cell volume and some biochemical parameters during pregnancy in North-west Nigeria due to scanty information documented in this part of Nigeria.
Materials and Methods: One hundred and fifty apparently healthy pregnant women, aged 17-40 years, were studied between August, 2010 and October, 2011 at Aminu Kano Teaching Hospital, Kano while 100 age-matched and apparently healthy, non-pregnant women, resident in Kano metropolis as the pregnant women, were used as controls. Blood samples collected from the

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subjects were analysed for packed cell volume (PCV), random blood sugar (RBS), urea and creatinine using standard laboratory techniques.
Results: There were significantly lower values of packed cell volume and random blood sugar in pregnant women compared to non-pregnant women (P<0.05) and higher value of urea level in pregnant women compared to non-pregnant women (P<0.05).The values of creatinine levels in pregnant and non- pregnant women showed no significant difference (P>0.05) while parity and maternal age showed no effects on the PCV levels during pregnancy.
Conclusion: This study has shown reduced PCV value in pregnant women probably due to haemodilution and dietary deficiency of iron while the lower value of RBS may be attributed to reduced consumption of cassava or carbohydrate rich foods in this environment. Elevated urea level in the studied pregnant women might be associated with their high protein diets.

Keywords: Changes; PCV; biochemical parameters; Nigerian pregnant women.

1. INTRODUCTION

Pregnancy is associated with normal physiological changes that support foetal growth and development [1]. During pregnancy, the woman's renal function, carbohydrate and protein metabolism and particularly the hormonal pattern are affected [2]. It has been reported that glucose is the primary source of energy for the foetus whereas accretion of nitrogen and protein is an essential component of foetal growth and synthesis of new foetal and maternal tissues [3].

During early pregnancy, glucose tolerance is normal or slightly improved and peripheral (muscle) sensitivity to insulin and hepatic basal glucose production is normal [4]. Glucose production increases with maternal body weight such that glucose production per kilogram body weight does not change throughout pregnancy [5]. Significantly increased blood glucose level during pregnancy could lead to gestational diabetes which is characterized by difficulty during delivery, abnormal foetal weight, adolescent obesity and neonatal hypoglyceamia [6-8].

Reduced packed cell volume (PCV) during pregnancy has been widely reported by previous authors [9-11] while decreasing PCV level with increasing gestation period was observed by other authors [12-14]. These findings have been associated with the inability to meet iron requirement for red cell formation, haemodilution and infection [15-18]. However, divergent views have been expressed by previous authors on blood glucose levels during pregnancy as Tran [2] and Afolayan and Tella [19] reported that there was no significant difference in blood glucose level between pregnant and non-pregnant women, other authors documented significantly increased blood glucose levels as the gestation advanced [20-21]. Lower values of blood urea nitrogen and creatinine during pregnancy have been reported by other authors [2,3] but Nduka and Ekeke [22] observed slightly increased serum creatinine level only at the last trimester of pregnant African women while some authors documented that there was no significant difference in creatinine value during pregnancy compared to non-pregnant women [23-24]. However, the wide range of urea has been associated with variations in protein intake, hepatic urea synthesis and renal urea excretion while that of creatinine has been associated with body muscle mass and the technique employed for creatinine measurement [23].

Some of these variations in haematological and biochemical parameters have been associated with socio-economic status, nutritional status or habitual dietary intakes and race [15,17,22,25,26]. These factors made this study on the determination of PCV, RBS, urea and creatinine levels during pregnancy in North-west Nigeria necessary as the findings could guide the doctors in the management of the pregnant women in this locality.

2. MATERIALS AND METHODS

After the approval of the ethical committee of Aminu Kano Teaching Hospital (AKTH), Kano, 150 apparently healthy pregnant women who attended antenatal clinic of Aminu Kano Teaching Hospital, Kano and aged 17-40 years, were studied between August 2010 and October 2011 at AKTH, Kano. One hundred, age-matched and apparently healthy, non-pregnant women who were resident in Kano metropolis as the pregnant women, were used as the controls. Informed consent was obtained from every participant in this study and the subjects (pregnant and non-pregnant women) who had hypertension (BP>140/90 mmHg), diabetes

mellitus, renal or chronic kidney disease were excluded from the study.

Venous blood sample was collected from each subject and 1.0 ml of the blood was added to dipotassium ethylene diamine tetra acetic acid (EDTA) to the final concentration of 1.5 mg/ml while 2.5 ml of the blood was put in the sterile plain bottle to obtain serum. EDTA sample was used for the determination of packed cell volume using micro-haematocrit method [27] while the serum was used for the analyses of random blood sugar (RBS) by RANDOX glucose oxidase method [28,29], urea by RANDOX Urease-Berthelot method [30,31] and creatinine using Jaffes method [32,33].

2.1 Statistical Analysis

All the data were analysed using statistical package for the social sciences (SPSS) 16 statistical software (SPSS Inc., Chicago, USA). The mean values and standard deviations of the parameters were determined and the differences between the results of pregnant and non-pregnant women were assessed using student's t-test while the effects of maternal age, parity and gestation period on the parameters were assessed using analysis of variance (ANOVA). P-values ≤ 0.05 were considered significant.

3. RESULTS

The PCV and biochemical changes in pregnant women are shown in Table 1. Pregnant women had significantly lower values of PCV and random blood sugar of 32.55±3.12% and 4.52±1.0 mmol/L compared to 34.44±3.25 and 5.38±1.12 mmol/L respectively in non-pregnant women (P<0.05) while significantly higher value of urea of 3.80±1.86 mmol/L was observed in pregnant women compared to 3.26±1.23 mmol/L in non-pregnant women (P<0.05). There was no significant difference when the creatinine value of 65.84±24.3 mmol/L for pregnant women was compared to 60.5±20.27 mmol/L of non-pregnant women (P>0.05).

The PCV and biochemical changes with gestation period are displayed in Table 2. PCV values of 34.0±4.15%, 32.05±2.85% and 32.53±2.78%, urea values of 4.17±2.09 mmol/L, 3.30±1.5 mmol/L and 4.20±2.0 mmol/L, and creatinine values of 73.33±30.98 mmol/L, 59.58±14.35 mmol/L and 69.73±28.43 mmol/L for first, second and third trimesters respectively, showed statistically significant differences (P<0.05) while the different values of random blood sugar (RBS) of 4.77±1.19 mmol/L, 4.3±0.89 mmol/L and 4.66±1.02 mmol/L for first, second and third trimesters respectively, were not statistically significant (P>0.05).

The effect of maternal age on PCV during pregnancy is revealed in Table 3. The changes observed in PCV values of 32.1±2.77%, 32.6±3.24%, 32.7±2.92% and 32.2±4.09% with maternal age groups 17-22 years, 23-28 years, 29-34 years and 35-40 years respectively, showed no statistically significant differences (P>0.05).

Table 1. PCV and biochemical changes in pregnant women in pregnant women in North-West Nigeria

Parameter	Non-pregnant women (Controls)	Pregnant women	*P* value
Number of subjects	100	150	
Packed cell volume (%)	34.44±3.25	32.55±3.12	<0.05
Random blood sugar (mmol/L)	5.38±1.12	4.52±1.0	<0.05
Urea (mmol/L)	3.26±1.23	3.80±1.86	<0.05
Creatinine (µmol/L)	60.5±20.27	65.84±24.3	>0.05

Table 2. PCV and biochemical changes with gestation period in North-West Nigeria

Parameter	First trimester	Second trimester	Third trimester	*P* value
Number of subjects	24	66	60	
Packed cell volume (%)	34.0±4.15	32.05±2.85	32.53±2.78	<0.05
Random blood sugar (mmol/L)	4.77±1.19	4.3±0.89	4.66±1.02	>0.05
Urea (mmol/L)	4.17±2.09	3.30±1.51	4.20±2.0	<0.05
Creatinine (µmol/L)	73.33±30.98	59.58±14.35	69.73±28.43	<0.05

Table 3. Effect of maternal age on PCV during pregnancy in North-West Nigeria

Parameter	17-22 years	23-28 years	29-34 years	35-40 years	*P* value
Number of subjects	24	67	48	11	
Packed cell volume (%)	32.1±2.77	32.6±3.24	32.7±2.92	32.2±4.09	>0.05

Table 4. Influence of parity on PCV in pregnant women in North-West Nigeria

Parameter	0 parity	1-2 parity	≥3 parity	≥3 parity
Packed cell volume (%)	32.4±3.57	33.0±3.18	32.4±2.66	>0.05

Influence of parity on PCV value in pregnant women is shown in Table 4 above. Different PCV values of 32.4±3.57%, P33.0±3.18% and 32.4±2.66% for 0 party, 1-2 parity and ≥3 parity respectively, showed no significance (P>0.05).

4. DISCUSSION

Pregnancy is associated with normal physiological changes that assist the nurturing and survival of the foetus [2]. However, variations in the values of haematological parameters in pregnant women have been linked to nutritional or habitual dietary status and race [15,22,25]. This study was carried out to determine the extent of these changes in haematological and biochemical parameters during pregnancy in North-west Nigeria.

In this study, significantly lower value of packed cell volume (PCV) was observed during pregnancy compared to that of non-pregnant women and this finding is in line with the earlier reports [9-11]. This study further revealed that PCV reduced significantly after the first trimester which agrees with the reports of Onwukeme and Uguru [12] and Akingbola et al. [13]. Decreased PCV value might be associated with increased plasma volume as the pregnancy progressed. However, reduced PCV during pregnancy has been associated with inability of the body to meet the iron required due to dietary deficiency, infection and haemodilution [15,16,18].

This study has further shown that maternal age and parity had no significant effects on PCV values during pregnancy and these findings are inconsistent with the divergent views expressed by previous authors [34-36] who associated anaemia with young maternal age while Olatunbosun et al. [36] linked increased parity to reduced prevalence of anaemia during pregnancy but Adinma et al. [34] attributed anaemia to grandmultiparity. The different findings in this study might be attributed to good dietary intakes and proper antenatal care which could be associated with provision of anti-malaria drugs, supplemental iron and folic acid for the pregnant women irrespective of the maternal age and parity in Aminu Kano Teaching Hospital, Kano.

This study has further indicated significantly lower value of random blood sugar (RBS) during pregnancy which agrees with the earlier report [2] but disagrees with the reports of Afolayan and Tella [19] that showed no significant difference in the fasting blood sugar level between pregnant and non-pregnant women while that of Nwaoguikpe and Nwakwe [20] revealed significantly higher value of blood sugar level during pregnancy. The study showed fluctuated RBS values in the three trimesters of pregnancy which are in contrary to the earlier observations [1,20,21] that showed increasing value of RBS level as the gestation advanced. However, the variations in blood glucose levels during pregnancy have been associated with maternal body weight, increased intravascular volume, socio-economic status and dependence on cassava and other energy rich foods [2,4,20].

Significantly higher urea level during pregnancy has been observed in this study which disagrees with the previous report that showed lower value [2,3]. The different values from various authors might be due to socio-economic status and habitual dietary intakes of the subjects considered. However, variation of urea levels from different authors could be linked to protein intake or nutritional status, hepatic urea synthesis and renal urea excretion [23,26].

This study has further confirmed that serum creatinine levels during the trimesters of pregnancy followed the same pattern of urea levels as earlier reported [26]. However, differences in the values of creatinine have been linked to the body muscle mass and measurement techniques [23] while reduced

urea and creatinine levels have been associated with increased blood volume and cardiac output during pregnancy causing about 50-60% increase in renal blood flow and glomerular filtration rate [37].

5. CONCLUSION

In conclusion, changes in PCV and biochemical values in pregnant women in this study are associated with anaemia, reduced blood sugar level and increased urea level. Anaemia in pregnancy as revealed in this study might be associated with haemodilution and dietary deficiency of iron while lower blood sugar level could be attributed to reduced consumption of cassava or carbohydrate rich foods in this environment. However, elevated urea level in this study might be due to intake of high protein diets by the pregnant women.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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