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ASSESSMENT OF PLATELET INDICES PROFILE OF PREGNANT WOMEN ATTENDING UNIVERSITY OF ABUJA TEACHING HOSPITAL, NIGERIA

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ABSTRACT

Background: Platelets initiate hemostasis by aggregating at the site of injury and plug endothelial defects that usually are a consequence of injuries sustained, in order to prevent further blood loss.

Objective of Study: This case-control study aims to determine the values of platelet counts and platelet indices and the effect in the study participants attending the university of Abuja Teaching Hospital Gwagwalada Abuja, Nigeria.

Materials and Methods: A total of 180 samples were enrolled for the study; this consist of 120 pregnant women as test participants and 60 non-pregnant women as control. Blood samples were collected in EDTA bottle, and complete platelet count and indices were carried out using an automated five parts haematology analyzer.

Results: The mean±SD platelet count of pregnant women was non-significantly higher than the control subjects (p=0.295). There was decrease but not significant difference in mean±SD platelets volume (MPV), platelets distribution width (PDW) and platelets larger cell ratio (PLCR) of pregnant women than the control subjects (p>0.05). There was a progressive decline in MPV with gestation age, whereas PDW was higher among pregnant women compared to non-pregnant women. The MPV progressive declined in pregnant women from the 1st to the 3rd trimester (p=0.036).

Conclusion: Platelet count decreases while MPV and PDW increase with the increase in gestation age. These parameters were normal in the non-pregnant controls. It's recommended to analyze for comprehensive platelet indices of pregnant women with the risk of coagulopathy to promptly and adequately manage associated sequelae.

Keywords: Platelet Indices, Thrombocytopenia, Nigeria, Gestational Coagulopathy

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INTRODUCTION

Pregnancy is a physiological condition and usually does not affect the general health of a pregnant woman. However, pregnancy results in hormonal, hemodynamic and haematological changes [1]. These physiological changes need to be viewed as typical adaptations determined by nature. Increased total blood volume and hemostatic changes help to combat the complications of haemorrhage at delivery [2].

It is often argued that altered hemostatic status is required as the maternal coagulation system prepares for the challenges of parturition, and aims to minimize intrapartum blood loss [3]. However, the alterations in the hemostatic system begin as early as the first trimester, suggesting a requirement for such changes in the proper progression of the early stages of pregnancy [3]. In addition to the role of the hemostasis system in the regulation of post-partum bleeding [3], alterations in hemostasis enable the necessary changes in the uteroplacental vasculature to support the establishment of the trophoblast invasion of the spiral arteries of the uterus early in gestations [3]. The altered haemostatic status during normal pregnancy presents many physiological challenges in the vasculature and results in an increased risk of excessive thrombosis, especially within the uteroplacental circulation. This enhanced pregnancy-associated thrombotic risk may provide the mechanistic basis for many of the major pregnancy complications, such as pre-eclampsia, HELLP syndrome (Hemolysis, Elevated Liver enzymes and Low Platelet count) and intrauterine growth retardation (IUGR) [4].

Assessing platelet count in pregnancy is of clinical importance. It is useful in making the diagnosis of HELLP syndrome, which often can be a complication of pre-eclampsia and eclampsia, determining the severity of these clinical disorders and assessing response level to treatment in HELLP syndrome [5].

Pregnancy is associated with endothelial stress and increased platelet aggregation in the uteroplacental circulation resulting in a progressive decline in platelet count with increasing gestational age. Furthermore, the increase in plasma volume associated with pregnancy results in dilutional thrombocytopenia [6]. Thus, platelet counts are generally lower in pregnancy compared to non-pregnant women, and thrombocytopenia is seen in about 10% of pregnancies. Rarely, this may be severe enough to cause maternal and neonatal morbidity and mortality. The elevated platelet aggregation in pregnancy has been attributed to increased formation of thromboxane A2, more intracellular calcium mobilization and reduced synthesis of cyclic Adenosine MonoPhosphate (cyclic AMP) [6]. In cognizance to these, the current study aims to determine the values of platelet count and platelet indices and the effect in the study participants attending the university of Abuja Teaching Hospital Gwagwalada Abuja, Nigeria.

MATERIALS AND METHODS

Study Area

This study was conducted at the University of Abuja Teaching Hospital (UATH), Gwagwalada, Federal Capital Territory (FCT) Abuja, Gwagwalada is about 62 km away from the FCT. It is one of the settler's towns of the FCT. The town is close to the Nnamdi Azikwe international airport along the Abuja –Lokoja Expressway. It is located between latitude 8°55' and 9° 00'N and longitudinal 7°00' and 7° 05'E. The hospital has an average of 3000 deliveries annually. The laboratory investigations were carried out at the haematology Laboratory of UATH.

STUDY DESIGN

This was a case-control study on pregnant women who consented to be part of the study at the antenatal clinic at the University of Abuja Teaching Hospital. Controls were enrolled from the female medical students undergoing clinical postings and rotations in the hospital. This study took place from 20th April to 30th December 2018.

Subjects' Selection Criteria

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Women who give informed consent in the clinic and apparently healthy with no history of diabetes mellitus, malaria, HIV/AIDS, HCV and HBV were included in the study. These data alongside
their ages, parity, gestation ages were extracted from their hospital folders through the assistance of the attending physicians and nurses.

Ethical Considerations

Ethical approval was obtained from the ethical committee of the University of Abuja Teaching Hospital, Gwagwalada, Abuja, Nigeria. Before recruited into the study, written and signed informed consent were obtained from all participating subjects in accordance with the standards of human experimentation and with the Helsinki Declaration of 1975.

ANALYTICAL LABORATORY METHODS

Platelet Count and Indices

The full blood count was carried out using the Genesis HA6000 Automated Hematology Analyzer (Perlong Medical Equipment Company, China). Among other parameters, the analyzer determined platelet count and its various platelet indices. For the purpose of this study, Platelet count (109 cells/L), Mean platelet volume (fL), Platelet distribution width and Platelet larger cell ratio were considered. Daily and per-run quality control for all the procedures for the automated platelet indices analyses were ensured.

Statistical Analysis

Data were presented as mean and standard deviation on the statistical package for social science (SPSS version 26) and analyzed using student's t-test, ANOVA for a significant difference in platelet indices between groups. Probability ($p \leq 0.05$) was used to determine the level of significance for all statistical analyses.

RESULTS AND DISCUSSION

Platelet incises studies in pregnancy has become of great interest owing to the recurrent hypercoagulability crisis accompanied with pregnancy. In this study, one hundred and eighty participants who met the inclusion and exclusion criteria were successfully enrolled. Among which one hundred and eighteen, (n=120), were the study group (pregnant women), while the control group (non-pregnant women) were fifty-eight (n =60). The mean±SEM age (years) of these women were 25.53±0.70, 31.05±1.03, 30.9±0.61, 29.32±0.60, for the non-pregnant women, those in their first trimester, second and third trimester, respective.

Table 1.0 compared platelet indices between pregnant and non-pregnant women. There was an increase in mean platelet count (PLT) among the subject when compared with the control group, however, not statistically significant, while, MPV, PDW, and Platelet larger cell ratio slight decrease in pregnancy when compared with the non-pregnant group. These changes are, however, not statistically significant ($p>0.05$).

Table 1: Comparison of Platelet Indices between Non-Pregnant and Pregnant Women

Platelet Indices	Non-pregnant Women (n=60)	Pregnant Women (n=120)	(n=120) t value	P value
Platelet count ($X10^9$ cells/L)	214.95±52.22	226.54±69.76	6 - 1.119	0.295
Mean platelet volume (fL)	10.27±1.81	9.74±3.63	1.046	0.297
Platelet distribution width	13.60±2.07	13.44±3.60	0.32	0.749
Platelet larger cell ratio	29.61±7.65	28.38±8.33	0.972	0.333

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This study showed that there are changes in the various platelet indices in pregnancy and mean values of these parameters differ from the control group (non-pregnant women). The absolute platelet count (PLT) increases in pregnancy. This is not in agreement with an earlier study by Boehlen et al. [7] where a significant platelet decrease was reported among pregnant women. Physiological changes in haematological parameters during pregnancy also reported a significant decrease in platelet count in pregnancy [7]. Our findings were familiar with the study on variations of platelets indices in pregnancy-induced hypertension by Fahmi et al. [8] where they noted that thrombocytopenia caused by either increased platelet destruction or decreased platelet production. In pregnancy, increased platelet destruction may be mediated by immunological mechanisms, abnormal platelet activation, or platelet consumption Increased destruction or utilization of platelets during pregnancy occurs in microangiopathies (exposure to abnormal blood vessels) such
as thrombotic thrombocytopenic purpura, haemolytic uraemic syndrome, haemolysis, elevated liver enzymes, low platelet (HELLP) syndrome, and pre-eclampsia [8].

Some previous studies agree with the physiologic findings in pregnancy, where platelet count decreases possibly due to increased destruction and haemodilution with a maximal decrease in the third trimester [9]. An increase in platelet count reported in this study could be attributed to sampling techniques or the analytical process as these may have some effect on the results.

Findings from this study showed a non-significant decreased level of MPV, PCT and PDW in pregnant women compared to the control subjects ($p>0.05$). These changes might be related to the blood volume expansion and hemodilution that occurs during pregnancy. Our findings were in keeping with earlier studies by Babah et al. [10] where a decrease in MPV and PCT pregnancy was highlighted [10]. Findings from our study are in consonance with that of Nooh and Abdeldayem [11] reported a decrease in the levels of MPV, PCT and PDW during pregnancy.

Table 2.0 compared platelet indices between non-pregnant and the various trimesters of pregnancy among pregnant women. It showed an increase in the value of Platelet count in the first and second trimester of pregnancy. There was a decrease in platelet count among subjects when compared with the control group in the third trimester. These are similar to the findings in previous work by Babah et al. [10] where he reported a statistically non-significant increase in platelet count in the first to the third trimester of pregnancy. Our findings could be attributed to the feeding pattern and habits of the subject, as dietary rich in iron and folate could enhance and foster the erythropoietic activities of the bone marrow, which could overwhelm physiologic hemodilution seen in pregnancy. Nevertheless, the progressive fall in platelet count with an increase in gestation did not cause thrombocytopenia in these trimesters of pregnancy as the values was still within the normal range (150–450 × 109/L).

Table 2: Comparison of Platelet Indices between Non-Pregnant and the Various Trimesters of Pregnant Women

Platelet Indices	Non-pregnant state (n=60)	First trimester (n=24)	Second trimester (n=52)	Third trimester (n=44)	F value	F value
Platelet count ($X10^9$ cells/L)	214.95±52.22	228.64±45.25	237.38±82.39	212.48±61.08	1.632	0.184
Mean platelet volume (fL)	10.27±1.81	10.41±0.83	10.33±0.92	8.73±5.70	2.913	0.036*
Platelet distribution width	13.60±2.07	13.28±2.17	13.48±3.29	13.45±4.45	0.056	0.983
Platelet larger cell ratio	29.61±7.65	28.29±7.74	27.90±6.89	29.00±10.12	0.44	0.725

There was a significant increase in mean platelet volume among subjects in the first and second trimesters when compared with the control group. But a significant decrease was observed in the third trimester among the subject when compared with the control group. Mean platelet volume (MPV) and platelet distribution width (PDW) were reported to increase during platelet activation [12]. Essentially, the decline

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in the third trimester could attribute to the physiologic hemodilution.

There was a decrease in PDW in the three groups of pregnant women, which were statistically non-significant. On the contrary, an increase in PDW was observed by Omorogiuwa and Aigborhuan [13], which was attributed to physiologic compensation for the decreasing platelet count and volume as pregnancy advanced [13]. Platelets having denser granules are bigger in size and metabolically more active [14]. PDW is more specific than MPV for the identification of platelet activity, and it is a simple, practical and specific marker for enhanced coagulation [12].

Table 3.0 compared the mean platelet volume between Non-Pregnant and the Various Trimesters of Pregnant Women. They were a statistically non-significant increase in the mean of mean platelet volume (MPV) in the first and second trimester among the subject when compared with the mean value of the control group. However, in the third trimester, a significant decrease in MPV was noted among the subjects. On the contrary, a longitudinal study by Giles [15] showed an increase in MPV increased with gestational age in a non-significant manner. The decline in MPV in the third trimester could be attributed to platelet consumption and hemodilution common the pregnancy.

From table 4.0, incidence and level of thrombocytopenia in non-pregnant and pregnant women were compared. Findings showed incident of mild thrombocytopenia among pregnant women when compared with the control group. This explains the normal physiologic changes in pregnancy, where the dilution effects overwhelm the erythropoietic activities of the bone marrow. However, pregnant women who have a setting for thrombocytopenia may be at a higher risk of the effect of this disorder in the third trimester of pregnancy.

Table 3: Comparison of Mean Platelet Volume between Non-Pregnant and the Various Trimesters of Pregnant Women using the least significant difference (LSD) post hoc.

Parameter	Groups		Mean Difference	P-value
	Non-pregnant state	First trimester		
Platelet count ($X10^9$ cells/L)	214.95±52.22	228.64±45.25	237.38±82.39	212.48±61.08
Mean platelet volume (fL)	10.27±1.81	10.41±0.83	10.33±0.92	8.73±5.70
Platelet distribution width	13.60±2.07	13.28±2.17	13.48±3.29	13.45±4.45
Platelet larger cell ratio	29.61±7.65	28.29±7.74	27.90±6.89	29.00±10.12

Table 4: Incidence and Level of Thrombocytopenia in Non-pregnant and Pregnant Women

Variables	Pregnancy Status			
Platelet Count	Pregnant, n (%)	Non-Pregnant, n (%)	X^2	P-value
Normal (150-400´109 cells/L)	105 (89.0%)	53 (87.9%)	0.043	0.836
Mild (100-<150´109 cells/L)	15 (11.0%)	7 (12.1%)		
Moderate (50-<100´109 cells/L)	0 (0.0%)	0 (0.0%)		
Severe (<50´109 cells/L)	0 (0.0%)	0 (0.0%)		

CONCLUSION

This study showed that there are changes in the various platelet indices in pregnancy and mean values of these parameters differ from the control group (non-pregnant women). Particularly, Platelet count

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decreases while MPV and PDW increase with the increase in gestation age. These parameters were apparently normal in the non-pregnant controls. It's recommended to analyze for comprehensive platelet indices of pregnant women with the risk of coagulopathy to promptly and adequately manage associated sequelae.

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