

Variations In Platelet Indices Among Healthy Nigerian Population

Abstract

Background The degree of platelet activation may be assessed by platelet indices such as platelet count (PC), mean platelet volume (MPV) and platelet distribution width (PDW). Platelet indices are potentially predictive, diagnostic and prognostic useful markers for platelet related disorders. Platelet number and indices are accounted for by genetic and non- shared environmental influences.

Objective. This study aims to evaluate platelet indices, a useful makers of cardiovascular disorders, in Nigerian population.

Methods One hundred and eighty-six (186) subjects were enrolled for this study (102 females and 84 males). Three (3) ml of venous blood was collected from each consenting subjects into an ethyl diamine tetra-acetic acid (EDTA) anticoagulant bottle at a concentration of 1.5mg/ml of blood. Full Blood Count (FBC) was determined using the haematology autoanalyzer-Mindray BC-5300.

Results. Thirty (30) were ≤ 30 years, 108 were ≥ 30 years ≤ 60 years while 48 were ≥ 60 years. Those with blood group A were 41, blood group B 28, blood group AB 5 and blood group O 112. The mean values for the platelet indices were: mean platelet volume (MPV) (fl) 9.547 ± 1.170 and 9.682 ± 1.054 , Platelet Distribution Width PDW () 14.69 ± 5.181 and 14.54 ± 1.946 , PCT (ml/l) 1.362 ± 1.173 and 1.47 ± 1.150 , among females and males respectively. The (PDW) showed significant difference in some age groups. Plateletcrit (PCT), which measures the total volume of platelets in a given volume of blood, showed significant difference for all the age groups. MPV and PDW were negatively correlated with PLT in all the age groups and sexes. PCT was positively correlated with PLT in all the age groups.

Conclusion Platelet indices differ and correlate significantly among age groups; this underlines the importance for reference ranges among different age groups

Key words: Platelets, Mean Platelet Volume, Platelet Distribution Width, Gender and Age

Introduction

Platelets/ thrombocytes are fragments of cytoplasm derived from megakaryocytes. Their diameter is between $1.5-3.0\mu\text{m}$, about $1/3$ or $1/4$ of the size of erythrocytes. They have an irregular outline. They have a bluish grey, oval-round shape with many purple red granules on light microscopy.

The primary function of the platelet is to maintain the vascular integrity by sealing ruptures in the vascular bed. They can function in both innate and adaptive

immunity. Bacteria endotoxin can activate platelets, promote platelet-neutrophil interactions, and enhance bacterial trapping by stimulating the production of neutrophil extracellular traps (NETs). This can degrade pathogens and also confer resistance to a variety of pathogens both gram positive and gram negative organisms.^[1] The MPV is a marker for platelet age. Platelets get smaller with age. The MPV is also, increasing used as a marker for bone marrow stress; thrombocytopenia is often associated with large platelets. A low platelet count with high MPV indicates that the bone marrow is producing platelets and releasing them rapidly into circulation. MPV serves as a marker for inherited platelet disorders; Bernard-Soulier Syndrome (GP1BA, GP1BB, GP9, FLNA), Gray Platelet Syndrome (NBEAL 2) and MYH9-related diseases (MYH9) are associated with very giant platelets^[2]. Wiskoh-Aldrich Syndrome (WAS, ARPC 1B) is associated with small platelets. MPV is also a marker for platelet reactivity. Young platelets released from bone marrow are more reactive than old smaller platelets-biomarker for cardiovascular risk. MPV is also used to find new genetic variants ^[3]. Platelet distribution width (PDW): is an indicator of volume variability in platelet size and is increased in the presence of platelet anisocytosis [4]. PDW directly measures variability in platelet size, changes with platelet activation and reflects the heterogeneity in platelet morphology. It is useful in distinguishing between reactive thrombocytosis (PDW normal) from thrombocytosis associated with myeloproliferative disorders (PDW increased) [4]. Both MPV and PDW are increased during platelet activation and are useful in the differential diagnosis of aplastic anaemia and ITP. Plateletcrit (PCT): it is an independent risk factor in patients with mitral stenosis[5]. It is the volume occupied by platelets in the blood. It can be used to determine if a patient needs platelet transfusion and is a useful screening tool for platelet quantitative disorders. There is variability in platelet count and platelet indices as a result of potential covariants (confounders): Age, Sex, Study Centres [4] etc. Within the wide normal range, there are some ethnic differences in platelet count [6]

Materials and Methods

This was a cross sectional study designed to determine the reference ranges for platelet indices in Nigerian population. The Research Ethics committee of the University of Nigeria Teaching Hospital, Enugu State approved the study (NHREC/05/01/2008B-FWA00002458-1RB00002323). The subjects gave their written informed consent in accordance with the declarations of Helsinki. One hundred and eighty-six (186) subjects were enrolled for this study (102 females & 84 males), 30 were ≤ 30 years, 108 were ≥ 30 years ≤ 60 years while 48 were ≥ 60 years. Those with blood group A were 41, blood group B 28, blood group AB 5 and blood group O 112. Three (3) ml of venous blood was aseptically and without stasis collected from each subject into tripotassium Ethylene diamine tetra-acetic acid (K_3 EDTA) anti-coagulant bottles and mixed by gentle inversion. All samples were

analyzed with the heamatology auto-analyzer **Mindray BC-5300**, within two - three hours of collection.

Inclusion Criteria: Participants were none smokers, none alcoholics, have not received blood transfusion in the previous six month, HIV negative, no urine protein or sugar, no history of malaria, no recent history of blood loss and no history of drug abuse etc

Exclusion Criteria: Anaemic patients, HIV positives, smokers, alcoholics, subjects with liver or kidney related diseases, recently transfused subjects, diabetics, subjects on medications, menstruating and pregnant women were excluded.

Statistical Analyses: The Statistical Package for Social Sciences (SPSS) version 20.0 software and **Graphpad Prism v5** were used. Correlation was assessed by the Pearson's correlation coefficient (r). Significance differences between the study groups was assessed by one way analysis of variance (ANOVA), while the statistical significance was set at $P < 0.05$.

Results

Table 1: Haematological Profile of study population

Variables	Females	Males	p-value
WBCx10⁹L	5.746±1.962	5.639± 1.214	0.5999
Neu#	2.667±0.8724	2.686±0.7318	0.5344
Lym#	2.594±1.377	2.478±0.8383	0.5945
Mon#	0.179±0.1572	0.168±0.1176	0.8997
Eos#	0.270±0.1673	0.274±0.2487	0.1433
Bas#	0.024±0.01590	0.024±0.0137	0.2227
RBCx10¹²L	4.102±0.7585	4.210±0.7657	0.5823
HGBg/L	109.1±23.19	111.2±23.23	0.6290
HCTLL	0.356±0.08492	0.352±0.06819	0.8588
MCVfL	84.34±8.268	84.39 ±6.628	0.6136
MCHPg	26.31±2.852	26.75±6.846	0.4434
MCHCg/L	313.7±24.39	316.8±17.85	0.6145
RDWSD FL	46.02±9.149	45.56±10.36	0.6945
PLTx10⁹L	218.8±72.16	224.5±62.49	0.5785
MPVfL	9.547±1.170	9.682±1.054	0.7137
PDW	14.69±5.181	14.54±1.946	0.8316
PCT mL/L	1.362±1.173	1.47±1.150	0.3715

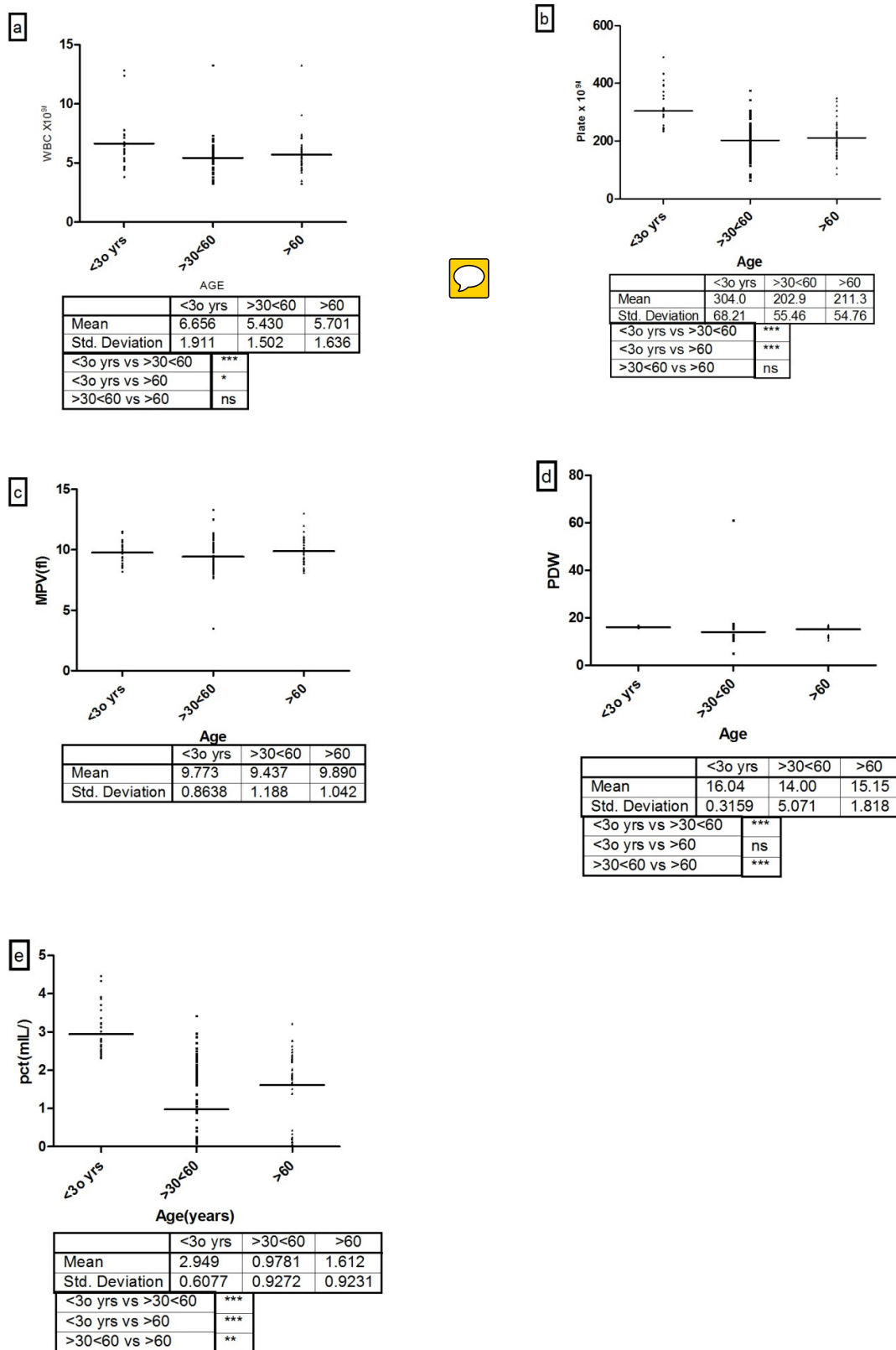


Figure 1: variations in(a) WBC,(b)platelet(c)MPV(d)PDW(e)PCT& Age

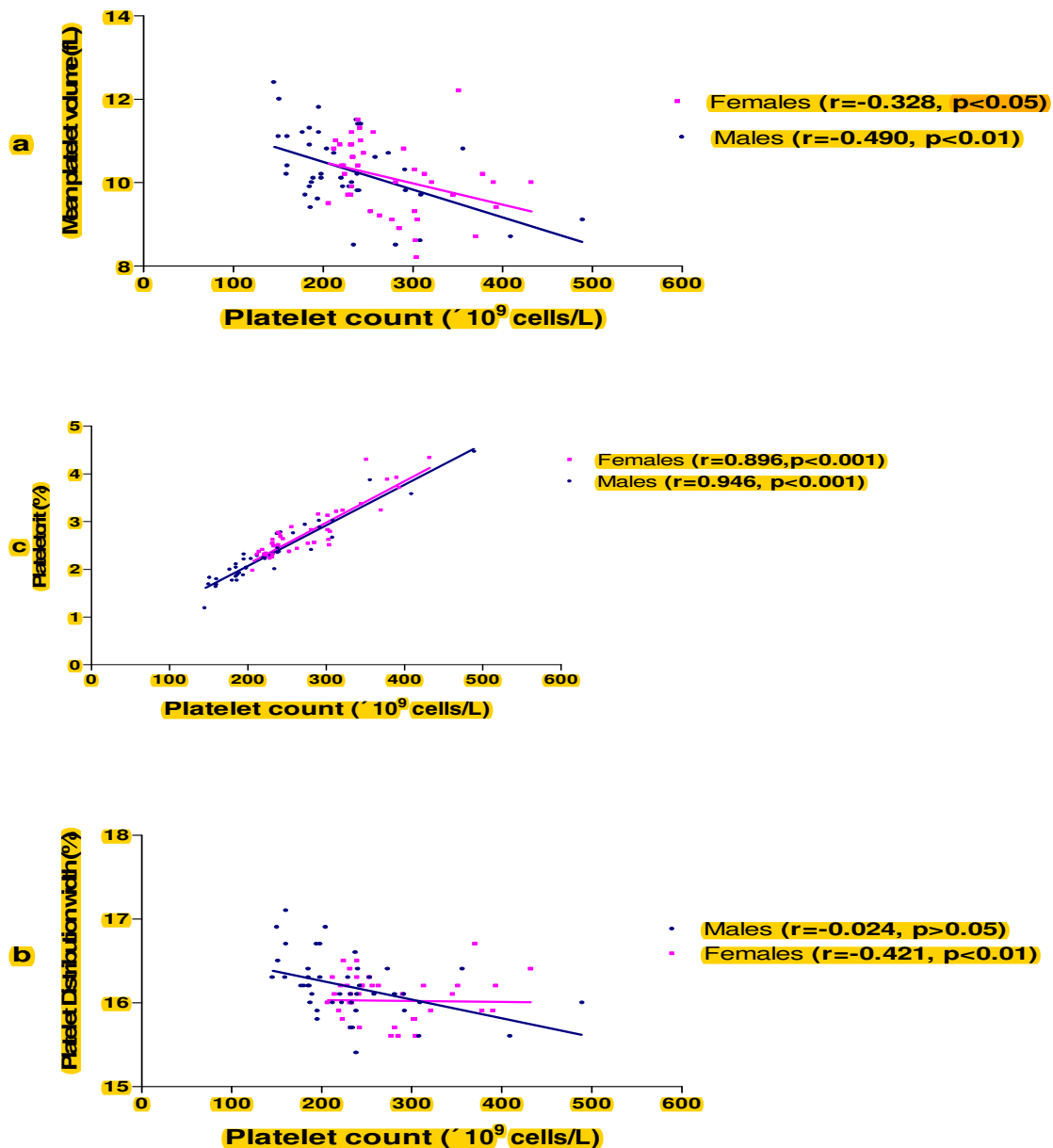


Figure 2 correlation of platelet count and platelet indices between the genders for the study population.

Discussion

There was a significant difference in platelet count between age's ≤ 30 and other age groups fig.2b. Platelet counts declined from childhood to adulthood as reported in Western countries [7, 8, 9]. This study records no significant difference in platelet count between the sexes (table 1); this may be accounted for by differences in auto analyzers used. Many studies suggested platelets vary with gender being higher in females than in male, [10, 7, 11, 8, and 9]. The hormone estrogen plays a key role in platelet production [12 & 13], and may contribute to the difference in platelet count

between the sexes. In vivo and in vitro studies on mouse showed that estrogen favours platelet formation in mouse, but no data is available in humans. Reduction in haematopoietic stem cell reserve during aging may be the mechanism responsible for the age-related reduction in platelets [14]. These variations occurred after 15 years of age and puberty is the implicating factor [15, 16]. The low body iron recorded in females at puberty, which resulted to low haemoglobin level, might be due to acute blood loss during menstruation [15, 16]. The acute blood loss triggers erythropoietin release to compensate for the red blood cells loss and simultaneously led to thrombopoiesis. This low body iron promotes platelet production observed in iron deficiency anaemia. Variations in platelets has also being attributed to differences in life style, diet habit, climate, geographical location, genetic, environmental, ethnic or tribal factors [17,18,19,20,22]. Decrease in platelet count in apparently healthy elderly males and females may be as a result of increased replacement of bone marrow by fatty tissues, deregulation of cytokines production in the elderly; low intake of micronutrients like iron, protein, vitamins and folic acid [21]. In addition, malaria parasite and hookworm infestation, which are common in Nigeria, could affect the platelet count. Nonetheless, all these mechanisms are still hypothetical and need further study.

There was no significant difference in MPV for all the age groups and among the sexes, although males had higher values than females. This is similar to the findings of Bain in 1985. The PDW showed significant difference in some age groups. PCT, which measures the total volume of platelets in a given volume of blood, showed significant difference for all the age groups.

MPV and PDW were negatively correlated with PLT in all the age groups ($r = -0.024$, $p > 0.05$; under 30 years), ($r = -0.265$, $p > 0.05$; between 30-60 years) and ($r = -0.677$, $p < 0.001$; above 60 years) and sexes (fig. 2). PCT was positively correlated with PLT in all the age groups ($r = 0.923$, $p < 0.001$; under 30 years), ($r = 0.929$, $p < 0.001$; between 30-60 years) and ($r = 0.922$, $p < 0.001$; above 60 years. Platelet count correlated negatively with MPV ($r = -0.393$, $p < 0.05$; under 30 years), ($r = -0.233$, $p > 0.05$; between 30-60 years) and ($r = -0.509$, $p < 0.01$; above 60 years). Similar correlations occur among these variables within the different genders figure 2. This underscores the significance for reference ranges for these variables.

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