

# Full Length Research Article

## PLATELET COUNTS AND MEAN PLATELET VOLUME AMONGST ELDERLY NIGERIANS

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### ABSTRACT

The study was conducted in Zaria, Nigeria aimed at determining reference values of Platelet Counts, Mean Platelet Volume and the relationship between the Platelet Count and Mean Platelet Volume. These parameters were determined from 400 healthy elderly subjects comprising 210 males and 190 females. with a mean age of 69.4±7.9 years. 400 young adults were used as control comprising 200 males and females respectively with a mean age of 24.1 ±4.2years. Healthy elderly adults had a mean platelet count of 161.8±3.0 X 10<sup>9</sup>/L and 214.5±3.1 X 10<sup>9</sup>/L in males and females respectively. Sex and age differences in platelet counts were observed in the elderly subjects (P < 0.05). The mean (SEM) for mean platelet volume for healthy elderly males and females was 9.8±0.6 fl and 9.7±0.6 fl respectively. There was an inverse correlation between mean platelet volume and platelet counts (r = - 0.286, P < 0.05). Platelet count was lower in healthy elderly subjects compared to the young adults control (P < 0.05). The use of separate reference value of platelet count in the elderly is advocated.

**Keywords:** Platelet count, Platelet volume, Elderly Nigerians, Zaria Nigeria.

### INTRODUCTION

Ageing is related to progressive decline in functional reserve of multiple organ systems increasing the probability of dysfunction and disease. The haemopoietic modulation becomes imbalanced as a result of progressive reduction in haemopoietic stem cells due to exhaustion of pluripotent cytokines and in production of haemopoietic growth factors (Mariza, 2007). Due to the universality of these age-associated changes, it is generally thought that a separate norm should be established for each age group (Madimir, 1981).

Globally and particularly in developing countries, the need to have measures that will help older people remain healthy and active cannot be emphasised.

Platelets are derived from fragmentation of precursor megakaryocytes in the bone marrow. They play a fundamental role in haemostasis and are a natural source of growth factors. Platelet disorders or thrombocytopathy may be either thrombocytopenia (decrease in number of platelets), thrombosthemia (decrease in function) or thrombocytosis (increase in number of platelets) (Bath *et al.*, 1996).

Platelets are heterogeneous with respect to their size, density and reactivity. It is suggested that changes in platelet size are determined at thrombopoiesis in the megakaryocytes and that those changes may precede acute cardiac events (Bernd *et al.*, 1999). Report by Thompson *et al.*, (1986) showed that platelet heterogeneity is not related to the ageing in circulation, but rather arise at thrombopoiesis. It is also demonstrated that platelet age and size are independent determinants of platelet function.

The large platelets (Giant platelets) were thought to be young because it had previously been suggested that platelets decrease in size as they age during their lifetime in the circulation (Martin *et al.*, 1983).

Values of normal platelet counts in man quoted in most standard haematological texts are derived from studies made on relatively small numbers of individuals using visual counting techniques. The advent of automatic counting and data processing has made it practicable to examine and evaluate larger bodies of data with relatively higher degree of precision than previously possible. The aim of this study was to establish reference values of platelet counts and mean platelet volume in elderly men and women in Zaria, northern Nigeria and to determine the relationship between mean platelet volume and platelet counts.

### MATERIALS AND METHODS

Four hundred (400) healthy elderly men and women Nigerians were screened in Zaria, comprising 210 males and 190 females whose age ranged between 65 - 85 years. Another set of 400 healthy young adults aged 20 - 30 years were used as control. Selection of volunteers was based on the following criteria: No history of drug usage, no recent history of blood loss, HIV negative, no malaria parasites in the blood, no urine protein or sugar, have not received blood transfusion in the previous six months, not smoking cigarette, and not drinking alcohol.

The study was performed after obtaining permission from the ethical committee of Ahmadu Bello University Zaria, and after an informed consent of the volunteers.

2 ml of venous blood was collected into containers containing sodium citrate as anticoagulant. Platelet counts and mean platelet volume were determined using modern haematology analyzer (Cell Dyn 4000, Abbott Laboratories). HIV screening, Malaria parasite test, and urinalysis were carried out on each subject and control to select the apparent healthy individuals.

**STATISTICAL ANALYSIS**

Results were expressed as Statistical Error of Mean (SEM). Statistical correlations were assessed using the Pearson correlation test. All statistical analyses were performed using SPSS (SPSS Inc., Chicago IL, Version 115.00).

**RESULTS**

The mean platelet counts in Zaria was  $161.8 \pm 3.0 \times 10^9/L$  in healthy elderly males and  $214.5 \pm 3.1 \times 10^9/L$  in females (Table 1). There was a significant decrease ( $P < 0.05$ ) in the mean platelet count in the healthy elderly males and females as compared to  $212.5 \pm 3.3 \times 10^9/L$  and  $237.7 \pm 3.2 \times 10^9/L$  in male and female healthy young adult control (Table 2). Generally, the mean platelet count in the elderly subjects was lower than in the young adult control, but the difference was not significant ( $P > 0.05$ ) (Table 3).

Mean platelet volume in the elderly males and females were  $9.8 \pm 0.6$  fl and  $9.7 \pm 0.6$  fl and those of the young adult control were  $7.6 \pm 0.5$  fl and  $7.5 \pm 0.8$  fl respectively. The increase in mean platelet volume in the healthy elderly subjects was statistically significant ( $P < 0.05$ ) compared to that of the young adult control (Table 3). There was an inverse correlation between mean platelet count and mean platelet volume ( $r = 0.28$ ).

**TABLE 1. PLATELET COUNT AND MEAN PLATELET VOLUME IN HEALTHY ELDERLY MALES AND FEMALES IN ZARIA**

Parameters	Males (n=210) Mean $\pm$ SEM	Females (n=190) Mean $\pm$ SEM
Platelets counts	$161.8 \pm 3.0 \times 10^9/L$ (range 105-289)	$214.5 \pm 3.1$ (range 143-300)
Mean platelets volume	$9.8 \pm 0.6$ fl (range 8.4-12.5)	$9.7 \pm 0.6$ (range 7.2-12.4)

**TABLE 2. PLATELET COUNT AND MEAN PLATELET VOLUME IN YOUNG ADULT CONTROL MALES AND FEMALES**

Parameters	Males (n=210) Mean $\pm$ SEM	Females (n=190) Mean $\pm$ SEM
Platelets counts	$212.5 \pm 3.3 \times 10^9/L$ (range 160-320)	$223.7 \pm 3.2$ (range 163-340)
Mean platelets volume	$7.6 \pm 0.5$ fl (range 6.8-10.5)	$7.5 \pm 0.8$ (range 6.5-10.5)

**TABLE 3. ANALYSIS OF PLATELET COUNT AND MEAN PLATELET VOLUME OF HEALTHY ELDERLY MALES AND THE YOUNG ADULT CONTROL**

**MALES**

Parameters	Elderly (Mean $\pm$ SEM)	Control (Mean $\pm$ SEM)	P-value
Platelet counts ( $\times 10^9/L$ )	$161.8 \pm 3.0$	$212.5 \pm 3.3$	0.05
Mean platelet volume (fl)	$9.8 \pm 0.6$	$7.6 \pm 0.5$	0.5

**FEMALES**

Parameters	Elderly (Mean $\pm$ SEM)	Control (Mean $\pm$ SEM)	P-value
Platelet counts ( $\times 10^9/L$ )	$214.5 \pm 3.1$	$223.7 \pm 3.2$	0.05
Mean platelet volume (fl)	$9.7 \pm 0.6$	$7.5 \pm 0.8$	0.5

## DISCUSSION

Results from this study showed gender difference in mean platelet counts, with the healthy elderly and the young adult control females having higher platelet counts than the elderly and the young adult control males. Gender-dependent differences in platelet count have been demonstrated in few studies. For example, amongst the Algerians, Brahim *et al.*, (1984) discovered that platelet count was  $225 \times 10^9/L$  in males and  $263 \times 10^9/L$  in females. In Spanish population, Lazomo *et al.*, (1998) reported sex differences in platelet count with higher values in females than in males. In Nigeria, higher platelet counts were reported in women than in men in separate studies conducted in Calabar and Zaria (Eessien *et al.*, 1973; Evelyn *et al.*, 1978). The report of Butkiewicz *et al.*, (2006) also observed gender-dependent platelet count, higher in women than men. The same authors observed that thrombopoietin concentration is also gender-dependent and is lower in women than in men.

Previous studies have suggested that healthy subjects of African ancestry have lower platelet counts than the Caucasians (Graham, 1987; Bain *et al.*, 1984; Wintrobe *et al.*, 1999, Koram, 2007). Decrease in platelet count in healthy elderly males and females observed in the present studies may be as a result of increased replacement of bone marrow by fatty tissue, deregulation of cytokine production in the elderly, low intake of micronutrients like iron, protein, vitamins and folic acid. Also, malaria parasites and hookworm infestation which are common in Nigeria, could affect the platelet count.

The work of Kadikoylu *et al.*, (2006) also observed that platelet counts increases in women with iron deficiency anaemia. Iron saturation is an important factor that affects platelet counts. It is suggested that decreased iron saturation might stimulate megakaryopoiesis. Moreover, iron may have an inhibitor effect on platelet counts.

The increase in mean platelet volume observed in the healthy elderly subjects was significantly different ( $P < 0.05$ ) compared to that of the young adult control. Increase in mean platelet volume in the elderly might not be unconnected with the thrombocytopenia, active thrombopoiesis and anaemia in the elderly. Platelets produced in response to thrombocytopenia not only have increased mean platelet volume, but are also reactive (Martin *et al.*, 1983). Mean platelet volume is determined by the conditions under which platelets are produced.

Several recent studies have pointed out the relationship between increased mean platelet volume and a variety of diseases (Bath *et al.*, 1996). Mean platelet volume has been shown to increase with activation of platelets, and has been seen in patients with cardiovascular risk factors such as obesity, diabetes mellitus and hypercholesterolemia (Threatle, 1993; Bath *et al.*, 1996; Daniella *et al.*, 2008; George *et al.*, 2008; Muscari *et al.*, 2008). The inverse correlation observed between platelet count and mean platelet volume ( $r = 0.28$ ) in the elderly subjects agrees with previous observations (Bessman *et al.*, 1985; Muscari *et al.*, 2008; Giles, 2008).

With the increasing number of blood counts being performed on relatively healthy elderly subjects, it is important to avoid causing unnecessary alarm or performing unnecessary investigations for

apparently thrombocytopenia when count observed do not differ from those usually observed in healthy elderly subjects of the same age and sex group. This requires that the haematology laboratories should take into consideration the age and sex of a patient when interpreting haematological variables.

The study suggests that there is significant difference in platelet count and mean platelet volume estimated between the healthy elderly subjects and the young adult control ( $P < 0.05$ ). There is therefore the need for separate values for platelet count and mean platelet volume for the elderly. Further studies to elucidate the physiological mechanisms which regulate mean platelet volume within the megakaryocytes are recommended.

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