

## Haematological Values for Children, Adults and Geriatrics in Nnewi and Environs, Anambra State, Nigeria

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Received date: December 13, 2017; Accepted date: January 09, 2018; Published date: January 12, 2018

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### Abstract

**Background:** Haematological parameters are very important in defining the health status of individuals. Hence availability of haematological reference ranges have been used as discriminators for individuals that are healthy or ill. Some independent factors such as age, gender, ethnicity, geographical location, lifestyle and method of assays are known to affect reference ranges, therefore in establishing reference ranges one must put these factors into consideration.

**Methodology:** A cross sectional study was conducted in Nnewi and its environ, and a total of 1,947 subjects were selected for this study using stratified random method. Whole blood sample was collected in EDTA bottle and tri-sodium citrate bottle from each subject for the haematological parameters. Kruskal Wallis and Man-Whitney statistical tool were used for the multivariable and two variables analysis respectively, using SPSS version 21 software package.

**Result:** Significant differences ( $p=0.00$ ) were observed among the different age groups; the adults had Hb, PCV and RBC values higher when compared with that of the children and the geriatrics. PT and CT tests showed significantly lower values ( $p=0.00$ ) in the adults when compared to the children and geriatrics. No significant differences ( $p=0.276$ ) were seen among the children, adults and geriatrics in MCV, INR and BT.

**Conclusion:** Some of the haematological parameters vary among the age groups; children, adults and geriatrics. The haematological values obtained from this study for children, adults and geriatrics, can serve as a reference values to guide health care providers in management of patients in Nnewi and its environ.

**Keywords:** Haematological values; Children: Adults and geriatrics

### Introduction

Blood is a vital circulatory tissue, composed of cells suspended in a fluid intercellular substance (plasma) with the major function of maintaining homeostasis [1]. The blood parameters are done to monitor overall health, to screen for some diseases, to confirm a diagnosis of some medical conditions, to monitor a medical condition, and to monitor changes in the body caused by medical treatments [2].

Reference values are set of values used to interpret a set of results. They are used in clinical trials as a guide to setting inclusion/exclusion criteria as well as the basis of safety monitoring for trial participants. And also, as biomarkers for assessing disease progression or response to therapy [3]. Children hematological values differ significantly from adults [4]. Lack of appreciation for the differences between children and adults, result in inappropriate handling of samples and incorrect interpretation of test results [5]. In the elderly, there is a significant decline in hemoglobin [6], which is more pronounced in men than women [7]. The haemopoietic modulation becomes imbalanced as a result of progressive reduction in haemopoietic stem cells due to

exhaustion and decreased production of haemopoietic growth factors [6]. Due to variations in age-associated changes, it is generally thought that a separate values should be established for each age group [8]. Infancy, childhood, and adolescence are characterized by a dynamic period of growth and development, hence the aim of this research was to establish reference haematological values for healthy children, adults and geriatrics in Nnewi and its environ, Anambra state, Nigeria.

### Materials and Methods

A cross sectional study was conducted in Nnewi and its environ, and a total of 1,947 subjects were selected for this study using stratified random method. They consisted of 638 children with a mean age of  $8.30 \pm 4.20$  years (males =320 and females=318), 652 adults with a mean age of  $40.24 \pm 12.92$  years (males=319 and females=333) and 657geriatrics with mean age of  $76.14 \pm 5.01$ years (males=322 and females=335). Whole blood sample was collected in EDTA bottle and tri-sodium citrate bottle from each subject at different period of the day (morning, afternoon and evening) for the following haematological analysis: Haemoglobin (Hb) in g/dl, Packed cell volume (PCV) in %, White blood cell count (WBC) in  $\times 10^6/l$ , Red blood cell count (RBC) in  $\times 10^{12}/l$ , mean cell haemoglobin (MCH) in

pg, mean cell haemoglobin concentration (MCHC) in %, mean cell volume (MCV) in fl, Platelet count in  $\times 10^9/l$  were done using Haematology analyzer (Erma PCE 210 made in Japan). Erythrocyte sedimentation rate (ESR) in mm/hr was measured using Westergren method. Prothrombin time (PT) in secs, prothrombin index (PT-Index), international normalized ratio (INR), activated partial thrombin time (APTT) in secs, activated partial thrombin time ratio (APTT-ratio) were assayed using CA-500 Automated Blood coagulometer. Clotting time (CT) in minutes was done using Lee and white method, and bleeding time (BT) in minutes was done using Ivy method.

### Statistical analysis

The data collected were analyzed using SPSS software package (version 21.0) for Windows. The results were presented as mean  $\pm$  standard deviation (SD). Level of significant (P-value  $\leq$  0.05) and confidence interval of 95% were considered as statistically significant at that level. The Kolmogorow-Smirnow test was used to test normal distribution. When a normal distribution was not confirmed, Mann Whitney test was used to compare two variables for significant differences and Kruskal Wallis test used for multiple variables. Null

hypothesis was rejected if P-values is less than and equal to 0.05 ( $\leq$  0.05). Graph Pad prism version 6 was used for graphs.

### Results

Significant differences (p=0.00) were observed among the different age groups; the adults had Hb:  $12.7 \pm 1.20$ ; PCV:  $38.11 \pm 3.52$ ; RBC:  $5.80 \pm 0.62$ , values higher when compared with the children Hb:  $11.65 \pm 1.65$ ; PCV:  $34.82 \pm 2.86$ ; RBC:  $5.75 \pm 0.63$  and the geriatrics Hb:  $12.05 \pm 0.96$ ; PCV:  $36.35 \pm 2.66$ ; RBC:  $5.56 \pm 0.57$ . PT and CT tests showed significantly lower values (p=0.00) in the adults PT:  $14.55 \pm 1.33$ ; CT:  $4.42 \pm 0.63$ ; when compared to the children PT:  $15.24 \pm 1.76$ ; CT:  $4.61 \pm 0.98$ ; and geriatrics PT:  $15.11 \pm 1.15$ ; CT:  $4.57 \pm 0.50$ . No significant differences (p=0.276) were seen among the children, adults and geriatrics in MCV, INR and BT. The males had significantly higher values (p=0.00) than the females in all haematological parameters assayed except in platelet count and ESR values, which were  $188.54 \pm 23.42$  and  $9.56 \pm 4.21$  and significantly lower (p=0.00) than the female values which were  $195.50 \pm 29.42$  and  $12.54 \pm 5.21$  respectively. Significant differences were also observed among the different ethnic groups in Hb, PCV and RBC indices (MCH, MCHC, and MCV) values (Table 1).

Haematological parameters	Age groups			P-values
	1-17 years	18-64 years	65-84 years	
ESR (mm/hr)	10.65 $\pm$ 5.31	10.05 $\pm$ 5.05	12.25 $\pm$ 5.41 <sup>b,c</sup>	0.00*
HB (g/dl)	11.65 $\pm$ 1.06	12.71 $\pm$ 1.20 <sup>a</sup>	12.05 $\pm$ 0.96 <sup>b,c</sup>	0.00*
PCV (%)	34.82 $\pm$ 2.86	38.11 $\pm$ 3.52 <sup>a</sup>	36.35 $\pm$ 2.66 <sup>b,c</sup>	0.00*
WBC ( $\times 10^9/l$ )	5.15 $\pm$ 0.98	4.66 $\pm$ 0.75 <sup>a</sup>	4.45 $\pm$ 1.02 <sup>b,c</sup>	0.00*
RBC ( $\times 10^{12}/l$ )	5.75 $\pm$ 0.63	5.80 $\pm$ 0.62	5.56 $\pm$ 0.57 <sup>c</sup>	0.00*
PLATELET ( $\times 10^9/l$ )	193.53 $\pm$ 27.87	192.42 $\pm$ 28.58	188.92 $\pm$ 26.77 <sup>b,c</sup>	0.04*
MCH (pg)	20.64 $\pm$ 2.20	21.25 $\pm$ 2.03 <sup>a</sup>	21.70 $\pm$ 2.41 <sup>b</sup>	0.00*
MCHC (%)	34.54 $\pm$ 1.56	33.37 $\pm$ 1.64 <sup>a</sup>	31.24 $\pm$ 1.86 <sup>b,c</sup>	0.01*
MCV (fl)	64.38 $\pm$ 4.59	64.08 $\pm$ 4.71	64.28 $\pm$ 4.50	0.28
PT (secs)	15.24 $\pm$ 1.76	14.55 $\pm$ 1.33 <sup>a</sup>	15.11 $\pm$ 1.15 <sup>c</sup>	0.00*
PT-INDEX	84.14 $\pm$ 10.36	88.42 $\pm$ 9.00 <sup>a</sup>	86.20 $\pm$ 8.43 <sup>c</sup>	0.00*
PT-INR	1.22 $\pm$ 0.15	1.11 $\pm$ 0.10	1.66 $\pm$ 0.13 <sup>b,c</sup>	0.00*
APTT (secs)	28.28 $\pm$ 5.24	29.79 $\pm$ 5.72 <sup>a</sup>	28.72 $\pm$ 7.82 <sup>b,c</sup>	0.00*
APTT-RATIO	0.99 $\pm$ 0.22	0.89 $\pm$ 0.14 <sup>a</sup>	1.01 $\pm$ 0.19 <sup>b</sup>	0.00*
CLOTTING TIME (secs)	4.61 $\pm$ 0.98	4.42 $\pm$ 0.63	4.57 $\pm$ 4.50	0.04*
BLEEDING TIME (secs)	1.47 $\pm$ 0.33	1.47 $\pm$ 0.30	1.52 $\pm$ 068	0.17

Data is expressed as mean  $\pm$  SD; \*Significant (P  $\leq$  0.05)  
a = Children (1-17 years) compared with Adult (18-64 years)  
b = Children (1-17 years) compared with Geriatrics (65-84 years)  
c = Adult (18-64 years) compared with Geriatrics (65-84 years)

**Table 1:** Haematological and coagulation profile parameters of the subjects grouped as children (age 1-17), adult (age 18-64), and geriatrics (age 65-84).

## Discussion

Medical decisions are of necessity, and are based on comparing patient values with reference ranges. When these ranges are derived from one population and then applied to another, unnecessary diagnosis of seemingly aberrant laboratory results may be the consequence. From this study the reference values for haematological parameters (HB, PCV, WBC, RBC, MCH, MCHC, MCV, Platelet, ESR, PT, PT-Index, PT-INR, APTT, and APTT-ratio, as well as clotting and bleeding time) were established and the details are shown in table. This study revealed that significant differences were observed among the different age groups; the adults show significant higher values in haemoglobin, haematocrit, red blood count, when compared with that of the children and the geriatrics. The difference could be attributed to diet, increase in body weight and high levels of androgen hormones among the adult male as compared to the infants/children and the geriatrics, This is similar with the result of the research carried out on the elderly in Gbaja, Lagos [9] and also with apparently healthy adult residing in Zaria [10]. The Haematocrit values for the elderly were lower than the adult values in our study. This may be due to old age red bone marrows, which are slowly replaced with yellow inactive marrow as earlier reported by Agoro et al.[11]. Prothrombin time, INR and clotting time shows significantly lower values in the adults when compared to the children and geriatrics. However the geriatrics showed significantly lower values in white blood cell count and platelet count when compared with the children and adults, and significantly higher value in erythrocyte sedimentation rate, when compared with the children and adults. No significant differences were seen among the children, adults and geriatrics in their mean cell haemoglobin and mean cell volume.

## Conclusion

This study has shown that age, gender, diet, physical environment and socio-economic condition, have effect on the haematological parameters assayed. Data from this study clearly indicated that the cited Caucasian's normal range presently in use in the haematology unit of NAUTH Nnewi and its environ is not totally appropriate for the people in this environment, hence this reference values.

## Acknowledgement

Special thanks to the Headmasters, Headmistresses and Principals of the Primary and Post-primary schools for allowing their pupils/

students to participate in the study. Much thanks goes to the different groups from the village, market traders and school children/students, who formed the subjects for this study.

## Competing Interests

There are no competing interests

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