

# REFERENCE RANGES OF SOME HAEMATOLOGICAL PARAMETERS IN HEALTHY NORTHERN NIGERIAN ADULTS

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## ABSTRACT

**Background:** The haematological values of populations differ due to numerous factors. It is essential to establish the normal haematological values in every population to ensure appropriate interpretation of results in health and disease states.

**Materials and Methods:** A total of 184 consenting apparently healthy adults (62 males and 122 females) were enrolled into the study. Three mls of venous blood was taken into EDTA bottle. The haematocrit, white cell count, platelet, red cell indices (MCV, MCH, and MCHC) and reticulocyte count were estimated using the Sysmex XT 2000i Haematology analyser according to the instructions given by the manufacturer.

**Results:** The mean values in the males were: Haematocrit; 47±3%; white blood cell count (WBC); 5.4±1.6x10<sup>9</sup>/l, platelet count; 296±66x10<sup>9</sup>/l, MCH; 27±2pg, MCV; 84±6fl, MCHC; 32±1g/dl, RDW-CV; 13.5%, and Reticulocyte of 1.2±0.6%. The mean values in the female subjects were: Haematocrit; 39±3%, WBC count; 5.4±1.6 x10<sup>9</sup>/L, Platelet count; 272.0±70 x10<sup>9</sup>/L, MCH; 27.0±2.0pg, MCV; 86.0±6.0fl, MCHC; 31.0±1.0g/dL, RDW-CV; 14.1±1.0% and Reticulocyte count of 1.4±0.8%. There were no statistically significant differences between gender for the means of WBC count and MCH, (p values; 0.865 and 0.861 respectively).

**Conclusion:** These values will serve as a useful tool in interpreting haematological parameters in the course of managing patients in this region.

## INTRODUCTION

Haematological reference values estimated from apparently healthy subjects in a population are essential for accurate interpretation of haematological test results for that population. This is because there are various physiological and environmental factors such as sex, age, body build, genetic background, altitude and diet that affect the haematological values.<sup>1, 2, 3</sup> Other variables to be considered in establishing reference values are the technique, timing of collection, storage of specimens and posture of subjects, though if standardized may be of less effect.<sup>1</sup>

Adult haematological reference ranges have not been previously established in Zaria. Western reference ranges documented in text books.<sup>1,4,5</sup> (see table 1) have been adopted for interpretation of results for our patients. This is inappropriate and misleading due to reasons mentioned above. This study therefore was designed to establish reference ranges in healthy male and female adults and to

compare these with values from populations in Nigeria and other parts of the World.

**Table I: Adopted Western Haematological Values<sup>4</sup>**

PARAMETERS*	MEAN ± 2SD	
	MALE	FEMALE
Haematocrit (%)	40-52	36-48
WBC count(x10 <sup>9</sup> /L)	4.0-11.0	4.0-11.0
Platelet count(x10 <sup>9</sup> /L)	150-400	150-400
MCV(fL)	80-95	80-95
MCH(pg)	27-34	27-34
MCHC(g/dL)	20-35	20-35
RDW-CV(%)	11.6-14.0	11.6-14.0
Reticulocyte count (%)	0.5-2.5	0.5-2.5

Appendix 2: Normal Values. Essential Haematology 5<sup>th</sup> Ed; 2006

\*WBC- White Blood Cell, MCV- Mean Corpuscular Volume, MCH Mean Corpuscular Haemoglobin, MCHC - Mean Corpuscular Haemoglobin Concentration, RDW-CV Red Cell Distribution Width- Coefficient of Variation

## SUBJECTS AND METHODS

Zaria and its environs is a semi urban area and the predominant occupation of the people of Zaria is farming but civil servants and businessmen also form a sizeable part of the population. The predominant religions are Islam and Christianity. Staple foods are mainly cereals, beans and tubers such as yam and sweet potato. Zaria has a tropical climate with a temperature ranges from 15.3 to 36.2°C and a rainfall that ranges from 0-816mm/month. Zaria has two main seasons the rainy season from April to October and a dry season from November to March.<sup>6</sup>

A total of 184 apparently healthy male and female adults aged between 15 and 60 were recruited for the study after obtaining informed consent from each of the subjects. Apparently healthy subjects, hospital staff, medical students and individuals presenting at the out-patient department for medical check up were included. Subjects with medical conditions such as diabetes, sickle cell anaemia and asthma as well as subjects who smoke cigarettes and pregnant female were excluded. Ethical approval was obtained from the ethical committee of ABUTH, Zaria.

Three millilitres of venous blood sample was taken from each subject into an ethylene diethyl tetra-acetic acid (EDTA) bottle. All samples were taken between 9.00am-12.00noon and analysed within 3hrs of collection using the Sysmex 2000i haematology analyser following the standard operating procedure outlined by the manufacturer. The following parameters were generated: haematocrit and reticulocyte count in percentage; absolute WBC and platelet counts per litre of blood. Other parameters include the red cell indices of MCV in fl. MCH in pg, MCHC in g/dl and RDW-CV.

The data obtained was analysed using the statistical programme for Social Sciences (SPSS), version 15. A P-value of 0.05 or less was taken as statistically significant.

## RESULTS

The 184 subjects enrolled for the study comprised of 122 (66.3%) females and 62 (33.7%) males. The means  $\pm$  2SD of the various parameters according to gender are presented in table 2 below. There was statistically significant differences (p-value = 0.05) between male and females in the parameters except for WBC count and MCH.

Table II: Descriptive statistics of Haematological parameters according to Sex

PARAMETER	MEAN		SD		MEDIAN		RANGE	
	M	F	M	F	M	F	M	F
Age (yrs)		29.3	4.9	10.2	25.0	25.0	16-48	15-56
HCT (%)	47.0	39.0	3.0	3.0	47.0	39.3	37.0-53.0	30.0-46.0
WBC ( $\times 10^9/l$ )	5.4	5.4	1.6	1.6	5.3	5.1	3.0-13.2	2.7-13.2
PLT ( $\times 10^9/l$ )	296.0	272.0	66.0	70.0	299.0	268.0	156.0-469.0	132.0-477.0
MCV (fl)	83.5	85.9	5.5	5.6	85.4	86.2	67.7-93.0	62.8-97.1
MCH (pg)	26.5	26.6	2.2	2.1	26.9	26.8	20.6-29.8	18.7-32.2
MCHC (g/dl)	31.8	30.9	1.1	1.2	31.6	31.0	29.6-34.8	26.7-34.4
RDW (%)	13.5	14.1	0.9	1.3	13.4	13.9	11.6-15.2	11.7-18.6
RET (%)	1.2	1.4	0.6	0.8	1.1	1.1	0.5-3.8	0.5-4.0

WBC-White Blood Cell, MCV- Mean Corpuscular Volume, MCH Mean Corpuscular Haemoglobin, MCHC - Mean Corpuscular Haemoglobin Concentration, RDW-CV Red Cell Distribution Width- Coefficient of Variation

Table III: Comparison of Means of Haematological parameters between male and female subjects

PARAMETERS	MEAN $\pm$ 2SD		P-VALUE
	MALE	FEMALE	
HCT(%)	47 $\pm$ 3	39 $\pm$ 3	0.001
WBC count ( $\times 10^9/L$ )	5.4 $\pm$ 1.6	5.4 $\pm$ 1.6	0.865
Platelet count ( $\times 10^9/L$ )	296.0 $\pm$ 66	272 $\pm$ 70	0.028
MCV (fl)	84 $\pm$ 6.0	86 $\pm$ 6.0	0.017
MCH (pg)	27 $\pm$ 2.0	27 $\pm$ 2.0	0.861
MCHC (g/dL)	32 $\pm$ 1.0	31 $\pm$ 1.0	0.001
RDW-CV (%)	13.5 $\pm$ 1.0	14.1 $\pm$ 1.0	0.013
Reticulocyte count (%)	1.2 $\pm$ 0.6	1.4 $\pm$ 0.8	0.043

WBC-White Blood Cell, MCV- Mean Corpuscular Volume, MCH Mean Corpuscular Haemoglobin, MCHC - Mean Corpuscular Haemoglobin Concentration, RDW-CV Red Cell Distribution Width- Coefficient of Variation

## DISCUSSION

The mean haematocrit for male and females were 47 $\pm$ 3% and 39 $\pm$ 3% respectively. There was statistically significant difference between the two sexes (p=0.001). The difference between the sexes may be accounted for by body weight, losses from menstrual bleeding and dietary habits. This is similar to means reported in Kano (45 $\pm$ 3% and 39 $\pm$ 4%), a neighbouring town to Zaria<sup>7</sup>, and Central African Republic (45 $\pm$ 4 and 37 $\pm$ 4).<sup>3</sup> The mean observed in this study are significantly higher than that of Pakistani population for both gender (male - 39 $\pm$ 2.6%, female - 35 $\pm$ 2.6%)<sup>8</sup>, this may be due to geographical variation and dietary factors. The mean difference between male and female subjects for WBC was not statistically significant (p= 0.865) which is the pattern in several

studies.<sup>2,3,9,10</sup> The WBC counts in this study is similar to the values obtained in Kano (4.7±1.6 and 4.9±1.7)<sup>7</sup> and Central African Republic (5.3±1.6 and 5.1±1.4)<sup>3</sup> but lower than the Caucasian values that have been in used in our centres (see table 1).

A statistically significant difference was recorded for platelet counts between male and female subjects (p=0.028). There is a significant difference between the values in both the lower and upper limits obtained from this study when compared to local and western values. Indeed there are as varied reference values for platelet count as are studies: (207±62 and 202±67),<sup>2</sup> (230±70 and 235±65),<sup>3</sup> (93-337)<sup>9</sup> and (140-420 and 130-400).<sup>10</sup> These differences could be due to biological variation, pre- and intra-analytical factors and geographical factors.

There was statistically significant differences between gender (p= < 0.05) for all the red cell indices except for MCH (p= 0.861). Again this is in contrast with the adopted values which show no gender difference. The values obtained in this study are generally lower except for the MCHC (see table 1). This may be attributable to factors such as diets, malaria and hook worm infestations which are common in our environment.

## CONCLUSION

The reference ranges established in this study vary from those reported in other populations outside Nigeria and there were significant differences between male and female subjects in most of the parameters. These values will serve as a useful tool in interpreting haematological parameters in the management of our patients as well as for research purposes.

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