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ORIGINAL ARTICLE

HEMATOLOGICAL AND LIPID PROFILES OF BLOOD DONORS AT RED CROSS CENTER IN ADDIS ABABA

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ABSTRACT

Background: *Physiological range of clinically important hematological laboratory values and lipid profiles of healthy population in Ethiopia is not well assessed.*
Objective: *to determine hematologic and lipid profiles of healthy blood donors in Addis Ababa.*
Methods: *Red Cross Society located in Addis Ababa was selected as a study area. 336 donors; age range between 18-58 years participated. Venous blood sample was collected by tube containing Ehtylenediaminetetraaceticacid tri potassium (EDTA) for hematology test and sterile tube for lipid test. After centrifugation serum was extracted for lipid test and transported to St. Pauls's Millennium Medical College (SPHMMC) within 5-8hrs of sample collection. IBM.SPSS version 21 was used for data analysis, statistical significance was set at P< 0.05 and 95% CL was accepted.*
Results*: Red blood cell count, mean corpuscular volume, platelet count and triglyceride level were significantly higher in the present study than the reference range. RBC indices, white blood cell, Hemoglobin, hematocrit, high density lipoprotein, low density lipoprotein and total cholesterol were higher in the reference range used in clinical practice. Significantly higher red blood count (p=0.000), Hg (p=0.000), Hematocrit (p=0.000) and mean corpuscular hemoglobin concentration (p=0.009) were observed in the male. Significantly higher platelet count and high density lipoprotein were observed among females (p=0.001 and p=0.001 respectively). No significant change in hematological laboratory values and lipid profiles was seen across age groups.*
Conclusion: *It is evident from this study that hematological and lipid variables obtained were statistically significantly different from the reference range currently used in clinical practice*
Keyword: *Hematological profile, Lipid Profile, Normal Values, Addis Ababa*

INTRODUCTION

A normal value is defined as values obtained by observation or measuring a particular type of quantity in reference individuals. The term reference value and normal value are used interchangeably; normal value is convenient term if reference individuals are healthy. (1) Global use of antiretroviral therapy (ART) supports the need for national or regional reference ranges; scientific evaluation of the efficacy of (ART) requires measurement of changes in physiological laboratory values from known established baseline. (2)

Clinical laboratory reference intervals have not been established in many African countries, and non-local intervals are commonly used for clinical trials among African participants. Laboratory reference intervals used in the laboratory settings are derived predominantly from North American and European countries. (3) Very little has been done to establish reference value regarding physiological serum and hematological values in Ethiopia. (4) Immuno-hematological reference range has been determined in factory workers at Akaki town. (5) Furthermore hematological laboratory values have been determined for healthy adults in Addis Ababa. (6-7)

Reference range used in the laboratory could not actually solve problem of developing country because of considerable variation in reference intervals. (8) Hence the present study was carried out to determine lipid profile and hematological laboratory values in healthy blood donors with the assumption that the study will give an insight towards further setting

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a reference value for Ethiopian population.

METHODS AND MATERIALS

This is cross-sectional study carried out at Ethiopian Red Cross Society located in Addis Ababa city. The study was carried out after obtaining ethical clearance from the department Of Physiology of Black lion hospital and administrative clearance from Ethiopian Red Cross Society. A total of 336 donors selected using convenient sampling method participated in the study.

Blood samples were taken from brachial vein while a donor lying supine with appropriate aseptic technique. 3ml of blood was collected by vacuum tube with *(*$EDTAK_3$) anticoagulant for hematologic tests and 2ml of blood collected using sterile tubes without anticoagulant for lipid test then centrifuged by (MEGAFUGE ® 1.0 HERAEUS) at 3500 rpm for 5 minutes, and 1-1.5ml of serum collected by neck tube for analysis. Sample after 5-8hr of blood collection were transported to (SPHMMC) for laboratory analysis.

Complete blood count (CBC) analysis is performed immediately following arrival of the sample by Automated Sysmex kx 21 hematology analyzer. Serum was stored for 2 days in a deep freeze and test was done using Cobas Integra 400 plus clinical chemistry analyzer.

White blood cell (WBC) counts, red blood cell count (RBC) and platelet count were made with direct current impedance detection method, hemoglobin (HGB) by non–cyanide detection method, and hematocrit (HCT) using pulse height detection. Chemistry analyzer performs analysis of all lipid parameters, testing is consolidated into one system with one reagent cassette design. The instrument carries out all test orders automatically and is equipped with fluorescence polarimetry, absorbance photometry, and module ion selective potentiometer.

Study sample size of 336 was determined after pilot study using the formula for single population mean with margin of error one is willing to tolerated (d) set at 0.2 and confidence set at 95 %. The data is summarized using descriptive statistics t- test. Mann-Whitney, Kruskal-Wallis rank test, and kennel's correlation were used in testing study point estimate for statistically significance. $P<0.05$ is used as level of significance and 95% level of confidence was accepted.

RESULTS

A total of 360 donors participated in this cross sectional study, however 5.2% of them were excluded due to infection and 2.2% were excluded due to sampling error thus; data of 336 donors was analyzed.

The variables are not normally distributed and data is summarized by median and range. The mean age of the study participants was 30.9±8.6 years while the median was 29 years. Age generally grouped in to two G1=(18-38years) and G2=(39-60 years) based on biological factors and previous studies.

The mean Body Mass Index (BMI) of study participants was 24.2 ±3.5Kg and ranged from 15.2 Kg to 38.7Kg. The average systolic and diastolic blood pressure was 128.3±10.4 mmHg and 81.3 ±6.1mmHg respectively (Table-1).

Table1: Age and Anthropometric data of study participants.

N=336	Median	Range
Age (years)	29.0	18-58
Weight (kg)	70.0	47-106
Height (m)	1.7	1.5-2.0
BMI (kg/m2)	24.1	15.2-38.7
BP (mmHg)		
Systolic	129.0	100-157
Diastolic	80.0	67-99

In this study, there was statistically significant difference in most hematological and lipid profiles between males and females. No significant difference was observed between the two age groups. The hematological laboratory values- RBC,HGB, HCT, and MCHC were significantly higher in male than females, whereas platelet count was higher in females. Regarding lipid profile, significantly higher high density lipoprotein HDL was found in females but, the triglyceride TG level was higher in males. No significant difference was observed in total cholesterol TC and LDL across gender groups.

Table 2; Summary hematological and lipid profile in male and female participants

Laboratory test	**Median (2.4th - 97.5th)** Male (n=262)	Female (n=74)	P-Value
White blood cell	5.7[2.85-9.65]	5.9[2.81-9.49]	0.490
Red blood cell	5.6[4.05-6.46]	4.9[4.20-6.23]	0.000*
Hemoglobin	15.6[12.21-17.70]	13.5[11.37-16.70]	0.000*
Hematocrit	48.9[37.47-56.60]	42.9[37.00-51.27]	0.000*
Mean corpuscular volume	88.9[81.49-96.40]	89.0[81.36-98.41]	0.801
Mean corpuscular hemoglobin	28.3[25.40-30.95]	28.4[23.85-30.57]	0.278
Mean corpuscular hemoglobin concentration	32.0[29.05-34.14]	31.6[28.87-33.77]	0.019*
Mean platelet volume	10.5[8.55-13.46]/fL	10.5[8.33-12.92]	0.375
Platelet count	264.0[132.00-423.00]	301.5[145-426]	0.000*
Total cholesterol	186.0[87.90-301.10]	176.0[78.70-292.30]	0.341
Triglyceride	155.0[61.55-340.80]	109.0[52.01-324.40]	0.000*
High density lipoprotein	45.5[23.00-82.68]	50.5[28.35-80.97]	0.002*
Low density lipoprotein	99.0[24.34-182.00]	95.0[24.85-150.40]	0.323

Comparing blood laboratory test values among the study participants with that of a reference range used clinically by one sample t test (MEAN OF REF) represents mean value for blood parameters in the reference range and (MEAN PRES) represents mean for blood parameters in the presents study. (Table 3)

The result showed that absolute calculated-t value was greater than tabulated-t value for all parameters. (MEAN OF REF)WBC=6.6,RBC=5.1,HGB=16.0, HCT=48.0, MCV=87.0, MCH=29.0, MCHC=35.0, PLAT=224.0, MPV=11.0, TC=175.0, TG=125.0, HDL=50.0 and LDL=115.0 and (MEAN PRES) WBC=5.8,RBC=5.4, HGB=15.0, HCT=47.4, MCV=88.8,MCH=28.8, MCHC=31.8, PLAT=273.4, MPV=10.6, TC=184.5, TG=158.9, HDL=97.9 and LDL=97.5.

If |Calculated- t| > |t-tabulated| t-test assumed significant difference across variables and in this study for all laboratory variables |Calculated- t| > |t-tabulated| t -test done between MEAN REF and MEAN PRES. This indicates that there is statistically significant variation between values in our study compared with the reference range. (Table 3)

Table: 3 t-calculated value and t-tabulated value of present study versus reference range

Laboratory tests	MEAN PRES	MEAN REF	t-tabulated	t-calculated
White blood cell count	5.8	6.6	0.000*	-8.44
Red blood cell count	5.4	5.1	0.000*	8.87
Hemoglobin	15.0	16.0	0.000*	-11.95
HCT	47.4	48.0	0.000*	-2.42
Mean corposcular volume	88.8	87.0	0.000*	8.74
Mean corpuscular Hemoglobin	28.2	29.0	0.000*	-10.49
Mean corpuscular Hemoglobin concentration	31.8	35.0	0.000*	-49.66
Platelet count	273.4	224.0	0.000*	13.2
Mena platelet volume	10.6	110	0.398*	-5.9
Total cholesterol	184.5	175.0	0.000*	-5.46
Triglyceride	158.9	125	0.000*	2.2
High density lipoprotein	47.9	50	0.006*	-2.78
Low density lipoprotein	97.5	115	0.000*	-15.09

In the present study, statistically significant difference between male and female study participants was found in laboratory measures including HGB, RBC, HCT, MCHC and Platelets. (9-11) HGB, RBC, HCT and MCHC values were higher in males whereas the platelet count was higher in females. This occurs with previous reports from north-west Ethiopia and other developing settings. (15-16) The difference in hematological laboratory test results by gender may well be explained by variation in androgen hormone, which influences erytherophoiesis.(5)

The blood laboratory values and lipid profiles of healthy adults observed in the present study was different from that of the reference values being used in clinical practice. (Table 3) With the exception of RBC, MCV and platelet counts, other blood laboratory values were higher in the reference ranges used in clinical practice. This is in agreement with other studies which also showed lower, HGB and RBC indices in African population compared with western countries. (12-14) The observed differences may be explained by environmental, dietary, ethnic and racial variations. (5)

The higher platelet count observed in females than in males occurs with what has been reported by previous studies. (16) It is suggested that gender-based differences in platelet count are most likely due to differences in hormone profiles where Estradiole has been demonstrated to trigger platelet formation in megakaryocytic cells. (16)

The statistically significantly higher HDL values was observed among female participants in our study is in agreement with finding of other study conducted in southern Ethiopia. (8) This may partly be due to the stimulatory effect of Estradiol in HDL among females in the child bearing age. Sex specific spontaneous variation in circulating lipid level (17) might also have contributed to this variation.

There was no significant difference observed in hematological and lipid parameters across age groups in our study is in agreement with reports from other studies. (18) In contrast to our study others have demonstrated a decrease in hematological laboratory values with advancing age, (19-20) as aging might lead to progressive reduction of hematopoietic stems cells. (21) It should however be noted that the maximum age among the participants in the present study is 58 years. In addition, the participants were healthy and this may be the reason for not finding differences in hematological laboratory measures among the different age groups in this study.

Conclusion: Our study has provided evidence that hematological and lipid laboratory values obtained from healthy adults is statistically significantly different from the reference range currently use in clinical practice. Our finding indicates variation in laboratory values of healthy adults from the reference range; however, we recommend further investigation to be done in other regions of the country to confirm our results and establish reference range.

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