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DETERMINATION OF SOME HAEMATOLOGICAL PARAMETERS OF 500 LEVEL UNDERGRADUATE STUDENTS OF SCIENCE LABORATORY TECHNOLOGY OF UNIVERSITY OF PORT HARCOURT

[1] H.O. Asuzu-Samuel, [2] Karibo Amakiri Okari

[1] Biomedical Technology, School of Science Laboratory Technology, University of Port Harcourt

[2] Department of Medical Biochemistry, Faculty Basic Medical Science, College of Medical Science, Rivers State University, Nkpolo-Oroworukwo, Port Harcourt

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Abstract: **Haematological parameters are important clinical markers in determining the health and disease status of an individual. The study aims to determine some haematological parameters of some 500 Level Undergraduate students of School of Science Laboratory Technology of the University of Port Harcourt. A total of 100 (One Hundred) year 5 undergraduate students of the School of Science Laboratory Technology (SSLT), University of Port Harcourt(50 males and 50 females) were randomly recruited for this study. Structured questionnaires will be administered to obtain the sociodemographic data of the study participants. Data such as the age, sex, Department, weight and height of participants will be collated. 5mL of venous blood samples were collected from each subject through the antecubital vein following the standard procedure for venous blood collection. The blood samples were sent to the laboratory for analysis of red blood cell (RBC) count, packed cell volume (PCV), haemoglobin (Hb) concentration, white blood cell (WBC) count and differential counts such as lymphocytes, monocytes, basophils, neutrophils, and eosinophils and platelet count. Results obtained were subjected to analysis using statistical package for social sciences. 86% of our participants were between the ages of 21 to 24 years, 14% within 25 - 28 years. There were significantly higher mean values of white blood cells, lymphocyte count and monocyte count in the male undergraduate students' than the female at p =0.001. The mean values of packed cell volume, red blood cells, haemoglobin concentration and eosinophil count were higher in the male than female respondents, but this difference was not statistically significant (p = 0.126, p = 0.557, p = 0.069 and p = 0.171 respectively). This study revealed that the undergraduate students used in this study had lower mean values of Packed cell volume (PCV), Haemoglobin (HB) concentration and Red Blood Cells (RBC) Count compared to the normal standard reference value.This study has established values for haematological parameters in apparently healthy undergraduate students'.**

Keywords: **Haematological, Blood, Determination, Undergraduate and Adults.**

1. INTRODUCTION

The assessment of haematological parameters is very necessary because, they are important proxy indicators useful in the assessment of immune status, therapeutic purposes and monitoring of disease progression and treatment outcome for proper patient management (Miri-Dashe *et. al.*, 2014). The values of hematological parameters are affected by a number of factors

even in apparently healthy populations. These factors include age, sex, ethnic background, body build, and social, nutritional, and environmental factors especially altitude (Evans *et. al.*, 1999). Red blood cells (RBCs) or erythrocytes (*Vinay et. al., 2007)*, are the most common type of blood cell and the vertebrate's principal means of delivering oxygen (O_2) to the body tissues—via blood flow through the circulatory system (Denomme, *2004)*. RBCs take up oxygen in the lungs, or gills of fish, and release it into tissues while squeezing through the body's capillaries. A typical human red blood cell has a disc diameter of approximately 6.2–8.2 µm(*Mary, 2004)* and a thickness at the thickest point of 2–2.5 µm and a minimum thickness in the centre of 0.8–1 µm, being much smaller than most other human cells. These cells have an average volume of about 90 fL (*Gregory, 2001)*with a surface of about 136 μm^2, and can swell up to a sphere shape containing 150 fL, without membrane distension. It has been demonstrated in several studies that some of the hematological parameters exhibit considerable variations at different periods of life. At birth, the total hemoglobin (Hb) level, Red blood cell (RBC) count, and packed cell volume (PCV) are shown to be higher than at any other period of life (Evans *et. al.*, 1999). This study aim is the Determination of some haematological parameters of 500 Level undergraduate students of School of Science Laboratory Technology, University of Port Harcourt. The Miri-Dashe *et. al.*, in 2014 conducted a study to evaluate the comprehensive reference ranges for haematology and clinical chemistry laboratory parameters derived from normal Nigerian Adults. They revealed a significant gender differences in hematological parameters. These differences present challenges in interpreting laboratory results from African countries based on reference ranges developed from other populations. Furthermore, there are variations in the variables among different African ethnic groups (Azikiwe, 1984). Age differences were also noted with male adults having higher levels than male adolescents for the red blood cell parameters (Zeh *et. al*., 2011). The WBC counts are increased in females compared to their male counterparts both African and Caucasian populations (Karita *et. al*., 2009, Saathoff *et. al.*, 2006). Accurate laboratory reference intervals are very important tools in clinical care and also in clinical trials for drug therapy and adverse effects but are unavailable for most African populations especially when they are required to participate in clinical trials (Zeh *et. al*., 2011). To date there have been few attempts and lack of literatures on the normal haematological indices for undergraduates in Nigeria especially in University of Port Harcourt. In 2007, Khalid *et. al.*, conducted to establish the normal values of various haematological parameters for healthy adult Pakistani males and females, and to compare these values with those obtained for other populations in both western and tropical countries.In Males, the mean Haemoglobin concentration (Hb) of 13.04 g/dl and Haematocrit (HCT) ratio of 0.39 l/l were significantly higher than females value of 11.63 g/dl and 0.35 l/l respectively. The mean Red Blood Cell (RBC) count of $5.3X10^{12}$/l in males was also significantly higher than the corresponding value of $4X10^{12}$/l in females ($p<0.05$). The value of Mean Corpuscular Volume (MCV) in males (76.30 fl) was significantly higher than in females (73.84 fl), ($p<0.05$). Similarly the Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) were significantly higher in males than corresponding values in females ($p<0.05$). On the other hand, the mean White Blood Cell count (WBC) of $8.25X10^9$/l in males was lower than mean value of 8.42 $X10^9$/l in females ($p<0.05$). Similarly the values for Platelet count of $255X10^9$/L in males werealso significantly lower than corresponding values of 255 $X10^9$/l in females ($p<0.05$). This study has established baseline values for haematological parameters in healthy Pakistani adults of Multan and surrounding areas. The sex difference of measured levels of all of these parameters has attained statistical significance. When the observed values of this study were compared with those quoted for the methods in use and those drawn from different populations, significant differences were revealed. Such differences are of accurate clinical interpretation ofhaematological investigation of patients (Khalid *et. al.*, 2007).

2. MATERIALS AND METHODS

Sample Collection

This is a cross sectional study, conducted at the School of Science Laboratory Technology, University of Port Harcourt, Nigeria.

Study Population

A total of 100 (One Hundred) year 5 undergraduate students of the School of Science Laboratory Technology (SSLT), University of Port Harcourt were randomly recruited for this study. The 100 students included 50 males and 50 females. The study was carried out between August and November, 2019.

Inclusion Criteria

Only year 5 Science Laboratory Technology undergraduate students of the University of Port Harcourt that willingly gave consent were recruited for the study. Those with good health condition based on their past medical history, were also recruited for the study

Exclusion Criteria

100 to 400 level undergraduate students of Science Laboratory Technology of the University of Port Harcourt and undergraduate students of other faculties of the University of Port Harcourt were excluded from the study. Students that refused to give consent were not recruited for the study.

Students with evidence of fever, history of drug abuse, alcohol consumption, smoking and chronic diseases such as diabetes mellitus, etc. were excluded from the study.

Female students who are menstruating or pregnant were also excluded from the study.

Ethical Considerations

The study followed the ethical principles guiding the use of human participants in research. Ethical approval was sought and obtained from the University of Port Harcourt Ethical Committee. All procedures were followed in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. (World Medical Association declaration of Helsinki, 2000).

Informed consent were obtained from all the research participants. With respect to confidentiality, no identifiers like name of respondents were required. All necessary information on the research that participants needed were provided. All information provided were kept confidential. All completed copies of the questionnaire were kept secured.

Data Collection

Structured questionnaires were administered to obtain the sociodemographic data of the study participants. Data such as the age, sex, Department, weight and height of participants were collated. 5mL of venous blood samples were collected from each subject through the antecubital vein following the standard procedure for venous blood collection. The blood samples were dispensed into Ethylene diamine tetra acetic acid (EDTA) anticoagulant bottles and mixed gently by inversion.

Haematological Analysis

The blood samples of each subject collected were transported to the Laboratory between 1 – 2 hours of collection for haematological analysis of the following using the Automated Haematology Analyser KX-21, (Sysmex Coporation, Kobe, Japan):

1. Red blood cell (RBC) count,
2. Packed cell volume (PCV),
3. Haemoglobin (Hb) concentration
4. Red blood cell indices such as mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC),
5. White blood cell (WBC) count and differential counts such as lymphocytes, monocytes, basophils, neutrophils, and eosinophils and
6. Platelet count.

Laboratory Analysis

Procedure For Packed Cell Volume (PCV)

Microheamatocrit method

The capillary tube was filled two-thirds full with well mixed venous blood, and one end of the capillary tube sealed with plasticine.

The filled tubes were then placed in the microhaematocrit centrifuge and spinned at 12,000rpm for 5minutes the spun tube was placed into a microhaematocrit reader, and the PCVread as a percentage. (haematocrit reader was used to read the result)

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Procedure for Haemoglobin Estimation

Added N/10 HCl into the tube up to mark 2g%

Mixed the EDTA sample by gentle inversion and filled the pipette with 0.02ml blood. Wiped the external surface of the pipette to remove any excess blood.

Added blood into the tube containing HCl. Wash out the contents of the pipette by drawing in and blowing out the acid two to three times. Mix the blood with the acid thoroughly.

Allowed to stand undisturbed for 10min.

Placed the hemoglobinometer tube in the comparator and add distilled water to the solution drop by drop stirred with the glass rod till it's color matches with that of the comparator glass while matching the color.

Procedure for White Blood Cell Count (WBC)

0.02ml of blood was added to 0.38ml of diluting fluid the improved Neubauer counting chamber was charged with the well mixed diluted blood. The cells were allowed to settle in a moist chamber for 3-5mins using 10x objective of the microscope, the four large corner squares area 1, 2, 3, and 4 were located. The area of these squares is $4mm^2$. Checked that the cells were evenly distributed, counted the total number of white cells in the four large corner squares in the same pattern ascribed for the red cell count.

Procedure for Differential Count – by Method

The differential count is expressed as perc**Manual**entage of the total number of cells counter.

Thin film with blood was made

It was allowed to dry

The surface of the thin film leshman stain was floored

It was left for 2 minutes

It was diluted with water

It was left for 8 minutes

Then rinsed in a low running tap water

The back of the slide was blotted

Then air dried

Examine under 100x oil immersion

Procedure for Platelet Count

Add 0.02ml of blood to 3.98ml of diluting fluid. The improved Neubauer counting chamber was charged with the well mixed diluted blood. The platelet was allowed to settle in a moist chamber for 3 to 5 minutes. The ruled area of the counting chamber under 10X objective was located.

The illumination was reduced by closing the iris diaphragm, platelet appear as highly refractile paticles.

The total number of platelets was counted using a high power (40x) objective in the four large corner squares ($4mm^2$)

Procedure for Red Blood Cell Count (RBC)

Whole blood was diluted appropriately using an isotomic diluted to avoid lysis of red cell. The number of red cell in a known volume and of known dilution is counted using a counting chamber

Techniques

0.02ml of blood was added to 3.98ml of diluting fluid. The improve Neubaur counting chamber was charged carefully with the well mixed diluted blood.

ISSN 2349-7823

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All was allowed to settle in a moist chamber for 3-5minutes. The ruled area of counting chamber under 10x objective of the microscope was located..

The cells were checked to be evenly distributed using 40x count the total number of red cells in five groups of 16 small squares in the central ruled area.

3. RESULTS AND DISCUSSION

Table 1: Socio - demographic characteristics of Science Laboratory undergraduate Students' (n=100)

S/No	Characteristic		Frequency (N)	Percentage (%) (N/n) *100
1.	Sex	Male	50	50
		Female	50	50
2.	Age	21–24yrs	86	86
		25–28yrs	14	14
3.	Department	Biomedical Tech.	42	42
		Biochemical Tech	12	12
		Microbiology Tech	13	13
		Physics Production Tech	13	13
		Ind. Chem & Prod Tech	12	12
		Geology & Mining Tech	8	8

A total of 100 participants comprising of 50 (50%) male and 50 (50%) female participants were enrolled in this study. 86 % of our participants were between the ages of 21 t0 24 years, 14% of the respondents 25 – 28 years. Of the number of subjects, 42% were undergraduate students of biomedical technology, 12% were undergraduate students of biochemical technology, 13% were undergraduate students of Microbiology technology Department, 13% were undergraduate students of physics production technology Department, 12% were undergraduate students of industrial chemical and production technology Department and Geology and mining technology Department all of School of Science Laboratory Technology (SSLT), University of Port Harcourt.

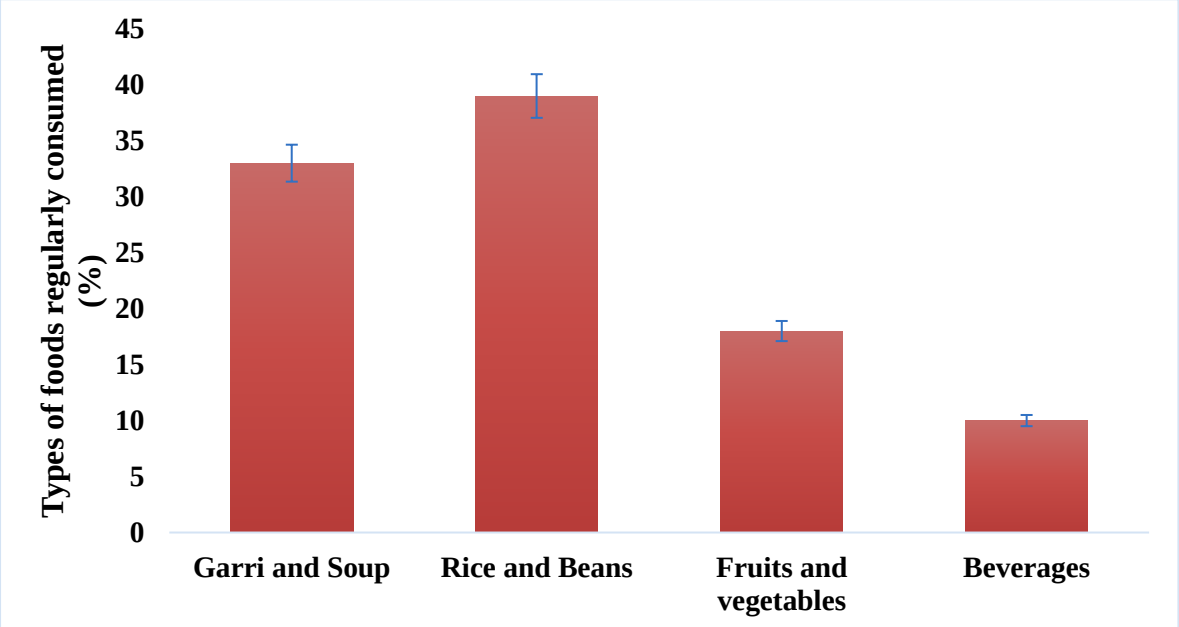

Figure 1: Types of daily foods intake

33% of the respondents consumes garri and soup regularly, 39% consumes beans and rice more, 18% consumes more of fruits and vegetables while 10% usually consume beverages more as seen in figure 4.1.

ISSN 2349-7823

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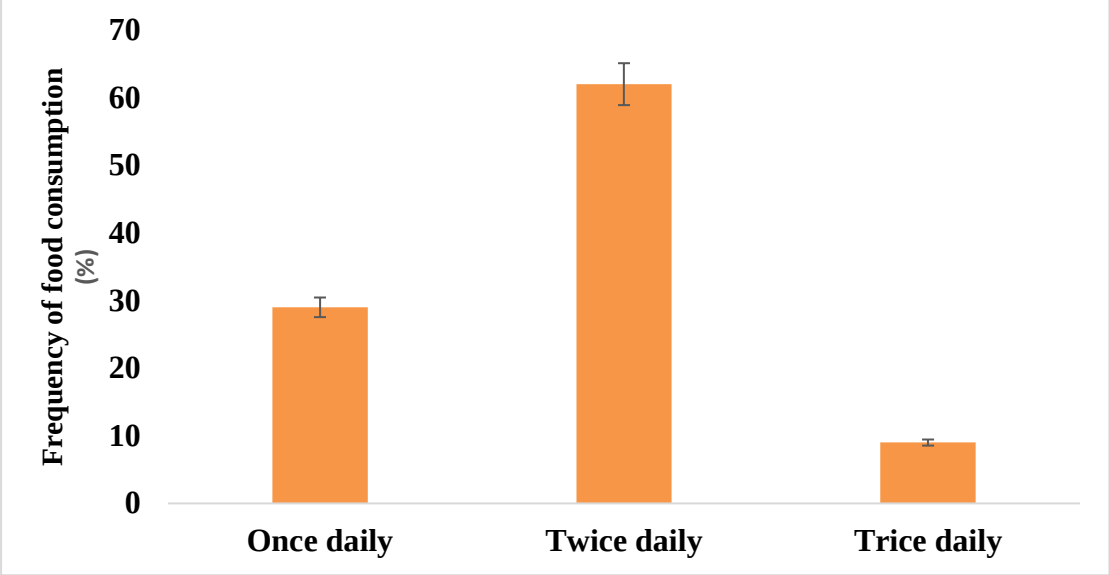

Figure 2: Frequency of daily foods intake

It was also shown in figure 4.2 that 29% of the respondents eats once daily, 62% eats twice in a day while 9% of the respondents' eats three times a day.

Table 2: Some erythrocyte Parameters of Science Laboratory Technology undergraduate students.

erythrocyte Parameters	Male (n = 50)	Female (n = 50)	p - value
PCV (%)	42.34 ± 4.65	41.78 ± 5.10	0.126
RBC ($X10^{12}$/L)	4.94 ± 0.85	4.90 ± 0.97	0.557
Hb (g/dl)	14.12 ± 1.54	13.87 ± 1.76	0.069

Data are presented as mean ± SD. *: Significantly difference at $p < 0.05$.

The mean values of packed cell volume, red blood cells and haemoglobin concentration count were higher in the male than female respondents', but these differences were not significant ($p = 0.126$, $p = 0.557$and $p = 0.069$ respectively) as shown in this Table.

Table 3: Some leucocyte and thrombocyte parameters of Science Laboratory Technology undergraduate students.

Leucocyte and thrombocyte parameters	Male (n = 50)	Female (n = 50)	p - value
WBC ($X10^9$/L)	4.72 ± 3.08	8.03 ± 1.71	0.001*
Lymphocyte (%)	42.16 ± 10.50	49.84 ± 6.31	0.001*
Neutrophil (%)	40.72 ± 10.41	47.58 ± 5.93	0.001*
Monocyte (%)	7.96 ± 4.26	6.98 ± 2.40	0.007*
Eosinophil (%)	4.94 ± 3.61	4.78 ± 2.91	0.171
Platelet ($X10^9$/L)	282.68 ± 157.06	340.36 ± 70.98	0.073

Data are presented as mean ± SD. *: Significantly difference at $p < 0.05$.

There were significantly higher mean values of white blood cells, lymphocyte count, neutrophil and monocyte count in the female undergraduate students compared to the males at $p < 0.05$. There was a non-significant ($p = 0.171$) increase in mean values of eosinophil count in males than in female undergraduate students'; and a non - significant (0.073) increase in the platelet count in females compared to the males as shown in table 3.

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Table 4: Comparative values of some erythrocyte Parameters of normal reference and that of the study result.

Erythrocyte Parameters	Normal Reference Values	Study Values
PCV (%)	43.37 ± 4.49	42.06 ± 4.86
Hb (g/dL)	14.84 ± 1.57	13.99 ± 1.65
RBC ($X10^{12}$/L)	4.98 ± 0.50	4.92 ± 0.91

Data are presented as mean ± SD; n = 100.

Standard Haematological values (Dacie and Lewis, 2006).

Comparative values of some erythrocyte parameters standard values and that of the study result of Science Laboratory undergraduate students are as shown above.

This research revealed that the undergraduate students of this study had lower mean values of Packed cell volume (PCV), Haemoglobin (HB) concentration and Red Blood Cells (RBC) Count compared to the normal standard reference value.

Table 5: Comparative values of some leucocyte and Thrombocyteparameters and that of the study result..

Leucocyte and thrombocyte parameters	Normal Reference Values	Study Values
WBC ($X10^9$/L)	6.33 ± 2.04	6.87 ± 3.09
Neutrophil (%)	44.29 ± 9.90	44.59 ± 9.11
Lymphocyte (%)	36.78 ± 9.61	43.50 ± 9.02
Monocyte (%)	5.90 ± 1.29	7.47 ± 3.47
Eosinophil (%)	3.72 ± 1.33	4.86 ± 3.26
Platelet ($X10^9$/L)	283.22 ± 85.09	311.52 ± 124.47

Data are presented as mean ± SD; n = 100.

Standard Haematological values (Dacie and Lewis, 2006).

Comparative values of some leucocyte and thrombocyte parameters standard values and the study result of Science Laboratory undergraduate students as shown above, showedhigher values of Mean values of white blood cells, neutrophil count lymphocyte count, monocyte count and eosinophil count for the studied undergraduate students' of school of science laboratory technology compared to the corresponding normal standard reference value. The mean value of platelet count of undergraduate students was higher compared to the normal standard reference value.

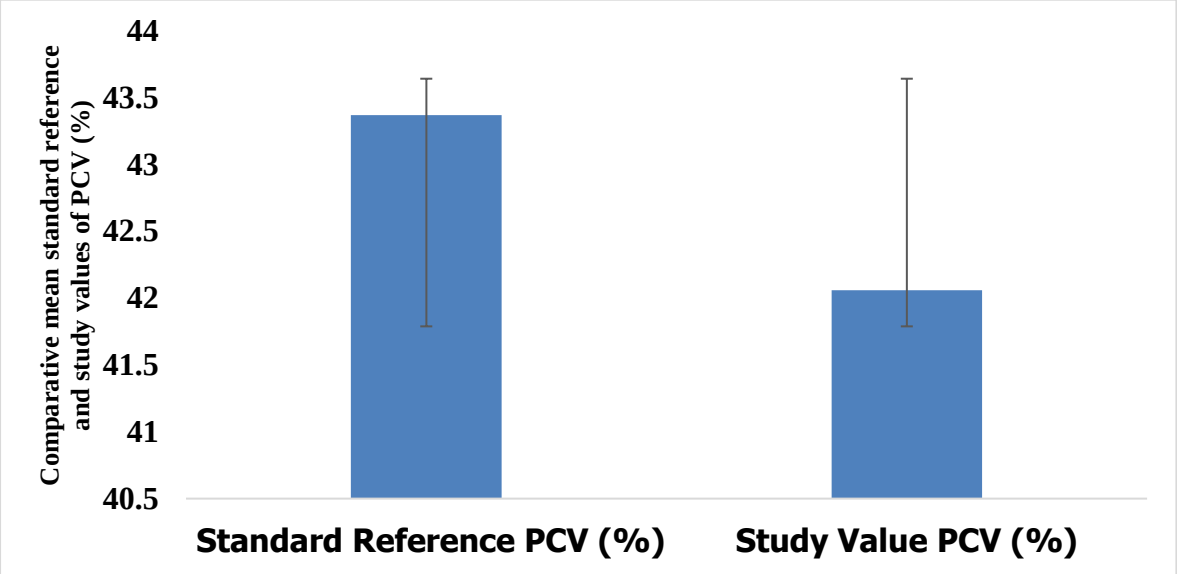

Figure 3: Comparative mean standard reference and study values of packed cell volume (%)

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Vol. 11, Issue 1, pp: (27-39), Month: January - March 2024, Available at: www.paperpublications.org

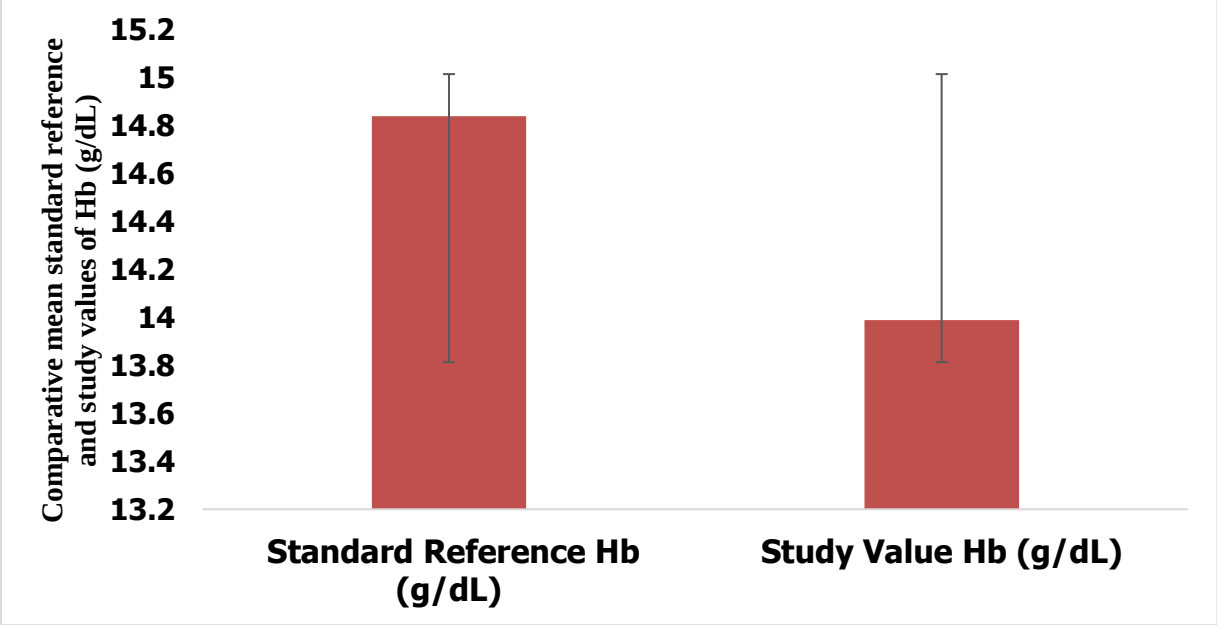

Figure 4: Comparative mean standard reference and study values of haemoglobin concentration (g/dL)

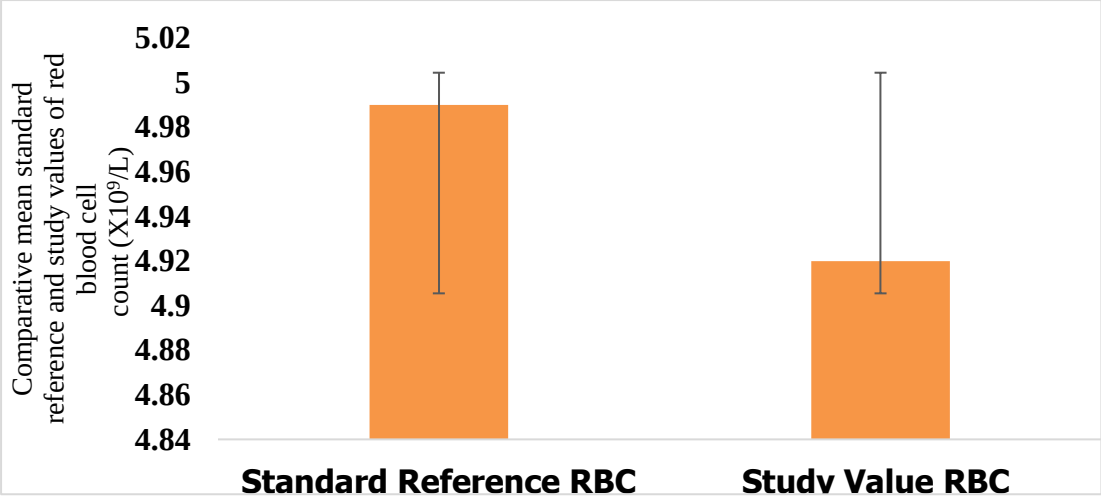

Figure 5: Comparative mean standard reference and study values of red blood cell count (X10^9/L)

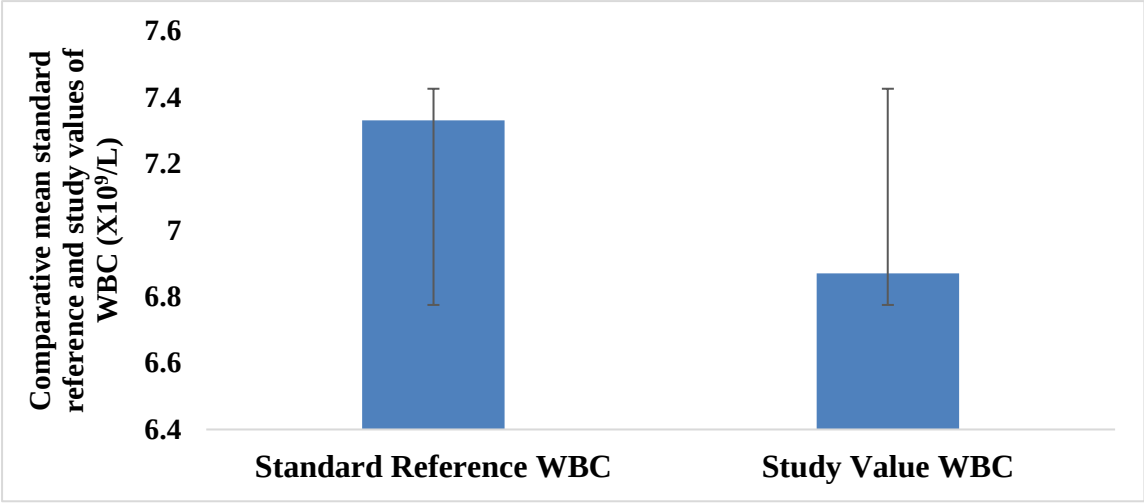

Figure 6: Comparative mean standard reference and study values of white blood cell count (X10^9/L)

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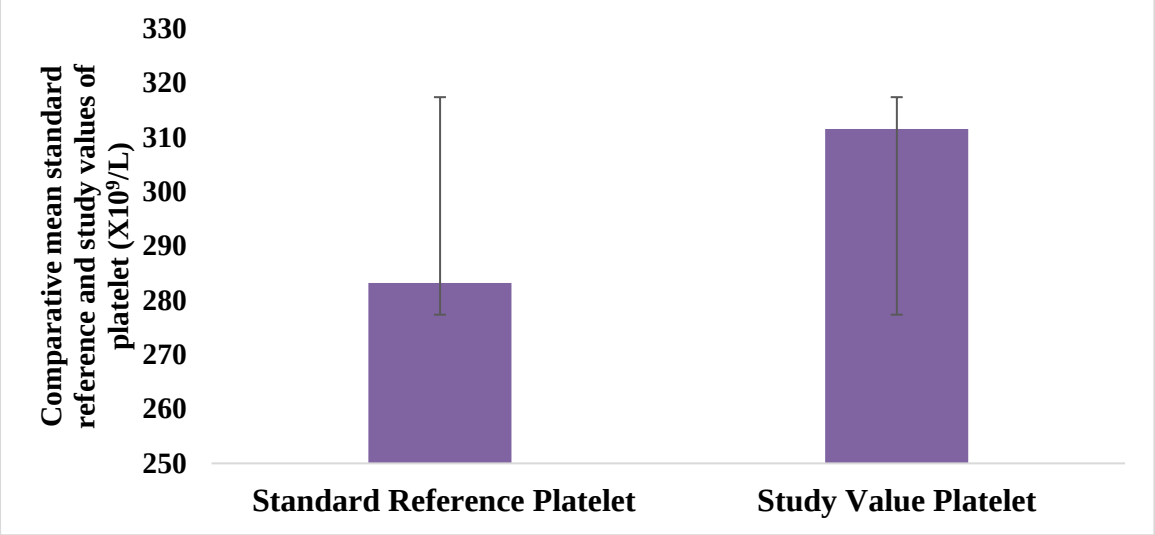

Figure 7: Comparative mean standard reference and study values of plateletcount ($X10^9$/L)

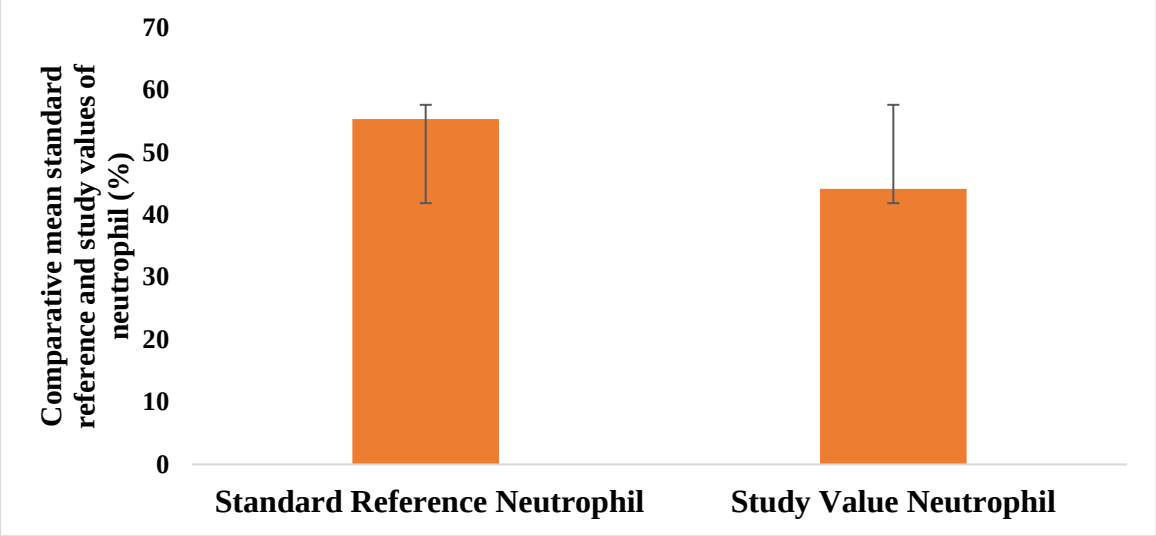

Figure 8: Comparative mean standard reference and study values of neutrophil count (%)

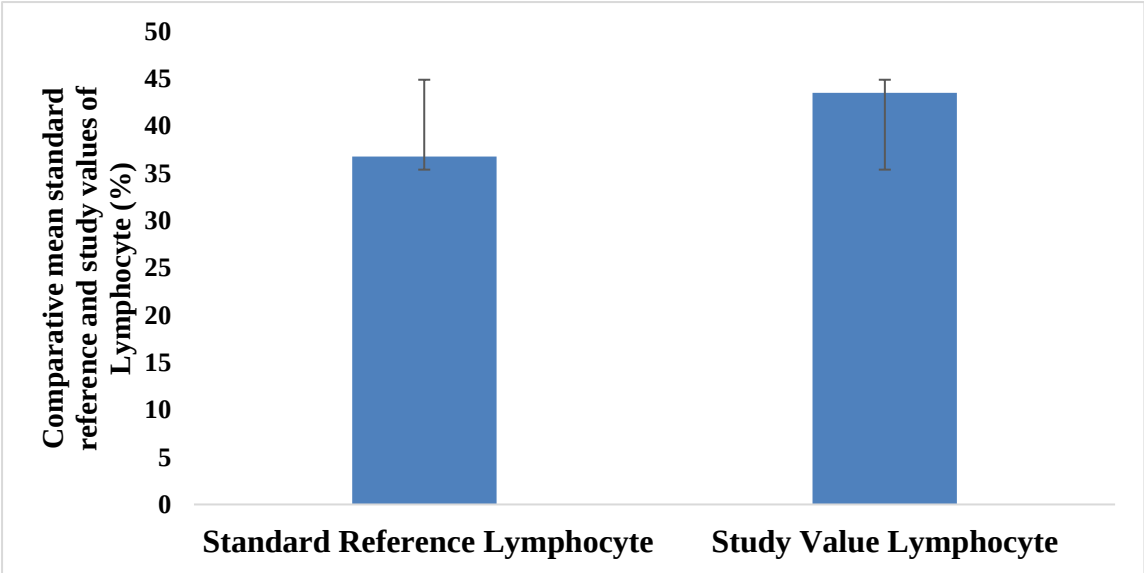

Figure 9: Comparative mean standard reference and study values of lymphocyte count (%)

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International Journal of Recent Research in Life Sciences (IJRRLS)
Vol. 11, Issue 1, pp: (27-39), Month: January - March 2024, Available at: www.paperpublications.org

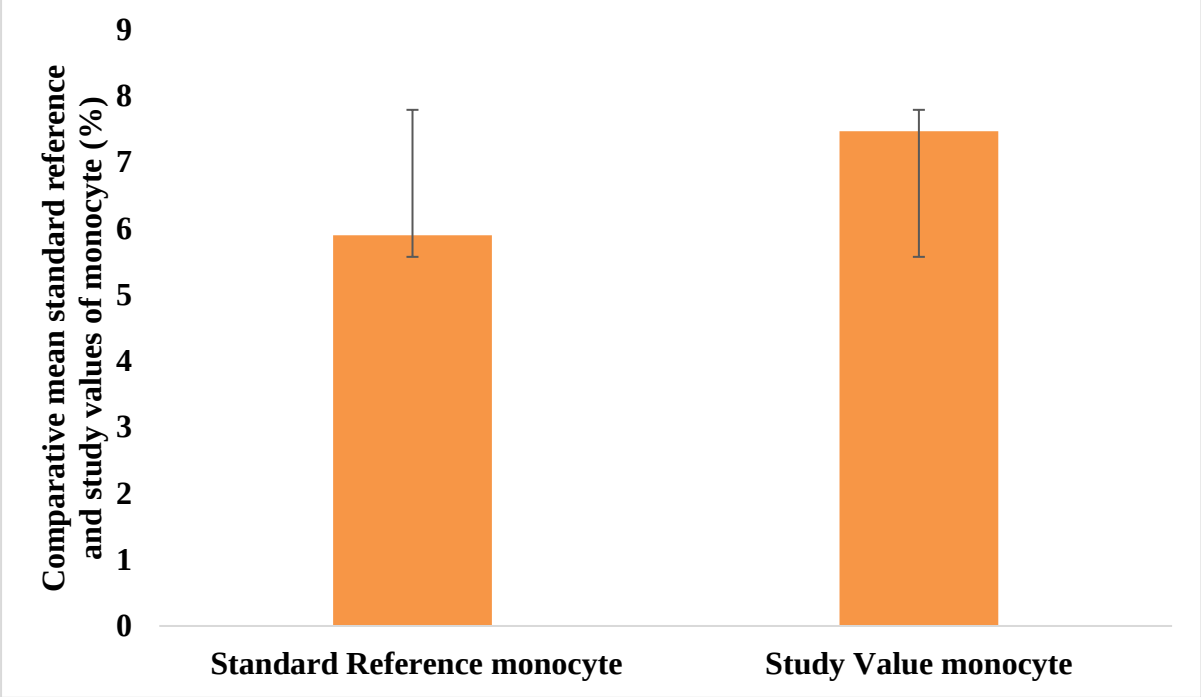

Figure 10: Comparative mean standard reference and study values of monocyte count (%)

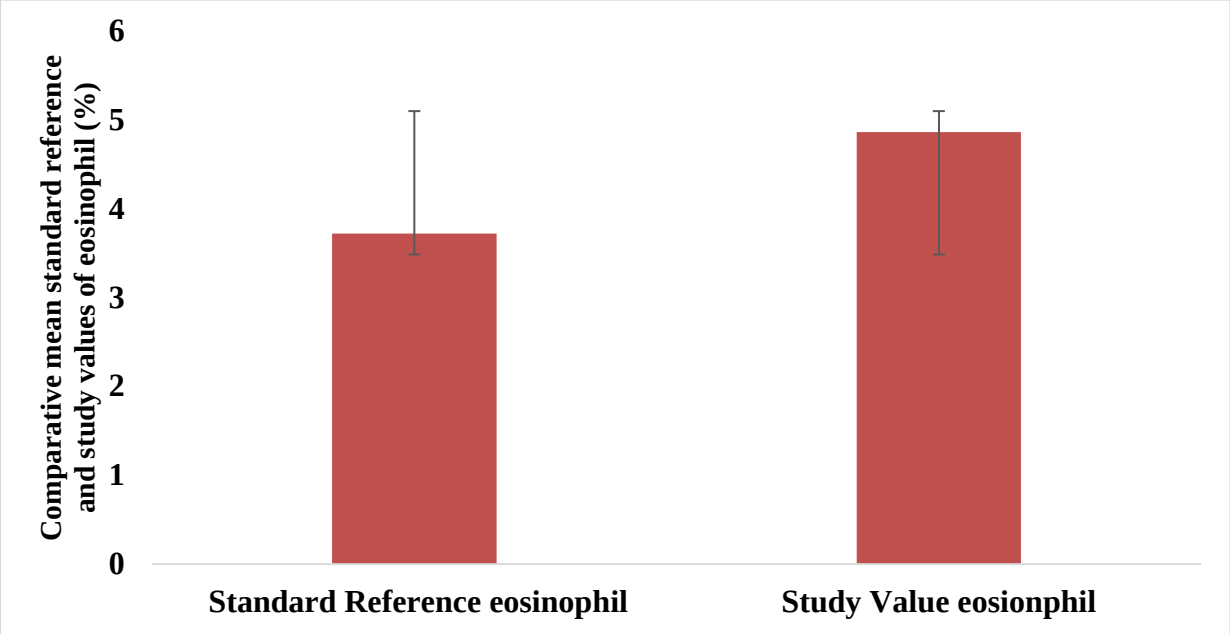

Figure 11: Comparative mean standard reference and study values of eosinophil count (%)

4. DISCUSSION

In this present study, some haematological parameters of 500 level undergraduate students of School of Science Laboratory Technology of the University of Port Harcourt were determined. This study revealed that majority of the undergraduate student's sampled were between the ages of 21 to 24 years which collaborates theoretically to the mean age of undergraduates in Nigerian universities. Hence, this group of individuals are more prone to some socio risk factor which may affect haematological parameters such as exposure to high level of academic stress especially during active semester periods, some lifestyles on campus (like smoking, alcohol consumption, drug abuse, etc.), poor feeding habits (and eating of junks) and exposure to mosquitoes infestation, etc. Extensive studies during the last three to four decades conducted in different populations have worked out normal reference ranges for hematological parameters in adults and children (Taylor

et. al., 1997) and have reported significant differences in different ethnic groups (Akdag et. al., 1996). Nutrition and physique also influence haematological parameters (Evans et. al., 1999).However, not much of reference haematological parameters for undergraduate students' is known in Nigeria especially in its south south region. When the values of haematological parameters observed in the present study were compared to values from standard haematological references (Dacie and Lewis, 1991), slight differences were observed. The values of the present study were slightly reduced when compared to the standard haematological values. The values of haemoglobin concentration, packed cell volume, white Blood cell and Red blood cell count from this study were lower than the standard haematological values. Similar differences were observed in African adult population compared with western adult populations (Hoffbrand et. al., 2006). The difference in the findings of this study and those reported elsewhere (Williams, 2005) could be due to many possibilities. It could be due to geographical variation, dietary factors and environmental exposures of the study subjects. The reason possibly attributed to the slight differences in these parameters observed in this study may be due to exposure to high level of academic stress especially during active semester periods, some lifestyles on campus (like smoking, alcohol consumption, drug abuse, etc.) poor feeding habits (and eating of junks) and exposure to mosquitoes infestation, etc. This finding is similar to reports from other studies conducted in Africa and also comparable to documentation from the United States of America (Kibaya et. al., 2008). This may be an indication of the potential effect of malarial parasitaemia on these haematological parameters (Garba et. al., 2015). The slight elevation observed in the mean values of white blood cells, lymphocytes, neutrophils eosinophils and monocytes for the studied undergraduate students may be as a result of ongoing infective processes in these individuals. The findings of this study had dissimilarity with the work of Okoroiwu et. al., (2014) that reported slight decline in basophils, eosinophil, monocytes, lymphocytes, neutrophils and white blood cells, but showed similar trend in the case of packed cell volume and platelets. The trend also showed some similarity with the work of Francis et. al., (2014) that reported significant decrease in pack cell volume, platelets, neutrophils, eosinophils, and significant elevation in white blood cells, erythrocytes and sedimentation rate, basophils, eosinophils, monocytes and lymphocytes. The observation in this study is comparable to the trend of packed cell volume, white blood cell and platelets reported by Garba et al., (2015). The lower mean values of red blood cells, haemoglobin concentration and packed cell volume recorded in the female undergraduate students' may be connected to their monthly menstrual cycle which may have been superimposed by the presence of malaria infestation, poor dietary intake and academic stress. Which may be evident in the significant elevation observed in the mean values of white blood cells, lymphocytes, neutrophils, eosinophils and monocytes in the female's undergraduate students. However, the mechanism of these actions are not well understood. But it is may be strongly linked to the risk factors stated above. The red blood cell count was reported to have been decreased during menstruation causing a decrease in the ratio of red blood cells to plasma (Dapper and Didia, 2002).These findings might be due to some nutritional differences although not investigated as earlier reported by Subhashree et al., (2012).In addition, this may also be due to the presence of sub-clinical iron deficiency in the control group as earlier reported by Subhashree et al., (2012) and Omorogiuwa A, Egbeluya, 2014. This result is consistent with a previous report by Francis et al., 2014 who recorded a slight higher lymphocyte count in the Nigerian population. The difference in findings of this study and those reported elsewhere Dacie and Lewis, (2006) could be due to many possibilities. It could be due to a bias in selection of the study subjects. For example, the groups studied by Viteri et al (1979) were highly selected subjects who were hookworm free, had adequate serum iron values; transferrin saturation fraction, serum folate and serum vitamin B12, and thus lower values were obtained in both sex groups than others Francis et al., (2014). On the other hand, Kelly and Munan (1997) from Canada reported lower values in their randomly selected population. In the present study, subjects were selected according to certain criteria. The major blood characteristics showed that packed cell volume, and platelets were lower in females compared to male, while white blood cell and erythrocytes sedimentation rate were higher in female compared to male. This trend has been reported by Francis et al., 2014. However, this research work also shows that the lower the red blood cells, haemoglobin concentration and packed cell volume recorded the higher the white blood cells, lymphocytes, neutrophils, eosinophils and monocytes, this may be due the fact that increase in one cell lineage production may cause decrease in other cell lineage production.

5. CONCLUSION

In conclusion, this study has established values for haematological parameters in apparently healthy undergraduate students'. This will serve as an important tool in the interpretation of laboratory results for clinical management of patients as well as for research purposes.

ACKNOLOGEMENTS

We acknowledge those students that participated in this study and School of Science Laboratory Technology, University of Port Harcourt.

DISCLOSURE OF CONFLICT OF INTEREST

Between the authors, there was no conflict of interest.

STATEMENT OF ETHICAL APPROVAL

This was sought and received from the University Ethical Committee and consent was received from each participated Student.

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