



SOME HAEMATOLOGICAL PARAMETERS IN NEW-BORN: A CASE STUDY PORT HARCOURT, RIVERS STATE, NIGERIA

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ABSTRACT

The haematological parameters of apparently healthy new-borns in Port Harcourt, Rivers State, Nigeria were studied. One hundred neonates comprising of 48 males and 52 females were recruited for this study from Orogbum Health Immunization Centre Ogbunali, Port Harcourt, Rivers State, Nigeria. The aim of this research was to establish reference values for neonates in Port Harcourt and to determine if differences exist in the haematological parameters between males and females. Blood samples were collected by strictly following accepted procedures and analysed with a DIANA-5^R automated Analyzer for packed cell volume, haemoglobin concentration, platelet counts, white blood cell (WBC) count (total and differential) and red blood cell (RBC) count while mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean Corpuscular haemoglobin concentration (MCHC) were calculated. The haematocrit was found to be $56.5 \pm 6.04\%$ in males and in females was $58.3 \pm 5.14\%$. RBC counts (5.25 million/ mm^3 for males and 5.21 million/ mm^3 for females). Haemoglobin concentration in males was 20.6 ± 1.93 g/dl and females 21.08 ± 1.93 g/dl. Platelet count was $298 \times 10^3/\text{mcL}$ for males and $265 \times 10^3/\text{mcL}$ for females. The total WBC count was 20.10×10^3 cells/ mm^3 for males and 19.40×10^3 cells/ mm^3 for females. The differential WBC count for neutrophil was 13.39×10^3 cells/ mm^3 for males and 11.09×10^3 cells/ mm^3 for females. Lymphocytes count 4.23×10^3 cells/ mm^3 for males and 4.11×10^3 cells/ mm^3 for females, the monocytes 2.44×10^3 cells/ mm^3 for males and 2.39×10^3 cells/ mm^3 for females while the basophil levels were inconsequential. The mean MCV for new-born was 26.66pg for males and 24.18pg for females, mean MCHC $34\text{g}/100\text{ml}$ for male new-borns and $33.00\text{g}/100\text{ml}$ for female new-borns and the mean MCV was 88.44 fl for males and 78.49 for female new-borns. Careful analysis of these values showed that there was no significant statistical difference between male and female values.

KEY WORDS: Neonates, Packed Cell Volume, Haemoglobin Concentration, Platelet Counts, White Blood Cell Count, Red Blood Cell Count.

INTRODUCTION

Blood consists of plasma the fluid medium and the cellular elements (red blood cells, white blood cells and platelets) suspended in the plasma (Ganong, 2003). The haematological parameters of great importance in surgery and diagnostic studies includes packed cell volume, haemoglobin concentration, platelet counts, white blood cell count (total and differential) and red blood cell count. Values derived

from packed cell volume (PCV), red blood cell count (RBC) and haemoglobin content includes the mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean Corpuscular haemoglobin concentration (MCHC).

Packed cell volume (PCV) also referred to as haematocrit is a measure of the total volume of erythrocytes relative to the total volume of whole blood sample. In neonates (cord blood), the normal PCV is about 40 to 50% (Maconi *et al.*, 2005). This



volume is relatively high at birth averaging 60% and decreases to about 54% by the 10th day of life. The measurement of the PCV is the most accurate and simplest method of determining the presence or absence of anaemia (<10%) or polycythaemia (>65%).

Haemoglobin is a globular molecule whose primary function is the transportation of oxygen from the lungs to the tissues and carbon dioxide from the tissues to the lungs. Measuring the haemoglobin concentration determines the oxygen carrying capacity of the blood as well as provide information on the erythropoietic status of the reticuloendothelial system (Baker and Silverton, 1985). Haemoglobin concentration is higher in neonates at birth about 21g/dl and decreases to about 11.6g/dl at about 1 to 2 years (Jopling *et al.*, 2009).

Platelets also called thrombocytes are formed in the bone marrow and play important roles in blood clot formation. Platelets count is the number of platelets per cubic millilitre of blood. The normal platelet count for neonates ranges from 150 to 400 x 10³/mcl and remains relatively unchanged until childhood (Sitaru *et al.*, 2005).

White blood cell (WBC) also called leucocytes are the mobile units of the body's protective system. WBC count involves the total and differential white cells. The total WBC count is the number of white cells per cubic millilitre of blood in a known volume of accurately diluted blood sample results expressed cells per cubic volume while the differential WBC count involves counting the individual white cells (neutrophils, basophils, eosinophils, lymphocytes and monocytes) present in the circulating blood (Mckenzie *et al.*, 1994). The WBC count in neonates is high at birth ranging from 6000 to 30000 cells/mm³ (Benitz 2010).

Red blood cell (RBC) count is the number of red cells per cubic millilitre of blood in a known volume of accurately diluted blood sample results expressed cells per cubic volume. At birth the RBC count is relatively high compared to any other period of life usually greater than 5.1 to 5.3 million/mm³ (Henry and Christensen, 2015).

Haematological indices MCV is the volume of red cells derived from the PCV and RBC count ranging from 80 to 95 femtolitres. MCH derived from the haemoglobin count and RBC count is about 29.98 ± 5.56 picogram (Kelly and Munan, 1977) and

MCHC the average volume of packed cell calculated from the haemoglobin count and PCV ranging from 32 to 35.5 g/100ml (Mukiibi *et al.*, 1995).

Neonates are new-borns within the ages of zero to the 4th week of life (Kuehn, 2008). This study was carried out on apparently healthy subjects and considered normal only if their haematological parameters fell within the defined haematological values found in neonates. Information on the haematological parameters of neonates in Port Harcourt is not readily available and the evaluation of these parameters is of utmost importance in neonatal childcare. The major objective of this research was to determine the haematological parameters in apparently healthy neonates, to establish reference values that can be used for diagnosis of haematological diseases of new-borns and to determine possible sex differences on these parameters.

MATERIALS AND METHODS

The study duration was for 1 month and blood samples were drawn from 100 apparently healthy new-borns (48 males and 52 females) at Orogbum Health Immunization Centre Ogbunali, Port Harcourt, Rivers State, Nigeria after informed consents were obtained from the parents. Blood sample collected were properly stored and transported to the laboratory within 6 hours and analysis by an automated cell counter (DIANA-5^R Analyzer) for the following parameters; haemoglobin concentration, haematocrit, red blood cell count, platelet count, total and differential white blood cell count. The haematological indices (MCV, MCH, and MCHC) were calculated from data obtained.

Data were analysed Statistical Package for Social Sciences (SPSS) version 20 to determine relationship and associations and student t-test was used to find out significant differences between means.

RESULTS AND DISCUSSION

Table 1 and Table 2 shows the minimum values, maximum values, median, mean and standard deviations of the haematological parameters of male and female neonates respectively.

**Table 1: Haematological Parameters of Male Neonates**

Parameters	Min	Max	Medium	Mean	Standard Deviation
RBC million/mm ³	4.81	5.46	4.92	5.25	2.01
PCV (hct)%	50.00	62.80	55.3	56.5	6.04
Haemoglobin Conc (g/dl)	18.01	23.42	18.57	20.06	1.83
Platelet x 10 ³ /mcl	146.00	420.00	213.00	298.00	20.74
Total WBC x 10 ³ /mm ³	9.0	32.04	24.79	20.10	24.08
Differential WBCx10³/mm³					
Neutrophil	6.80	13.11	7.54	10.39	11.9
Lymphocytes	1.94	4.20	2.33	3.23	13.1
Monocytes	0.92	2.00	1.02	1.44	12.1
Eosinophils	0.50	1.11	0.74	0.89	1.65
Basophil	0.01	0.03	0.01	0.02	0.01
MCH (pg)	22.28	31.25	24.19	26.66	4.27
MCHC (g/100ml)	29.00	37.00	31.00	34.00	1.49
MCV (fl)	75.08	98.50	84.39	88.44	12.78

Table 2: Haematological Parameters of Female Neonates

Parameters	Min	Max	Medium	Mean	Standard Deviation
RBC million/mm ³	5.01	5.23	5.04	5.21	0.11
PCV (hct)%	51.06	65.10	45.3	58.3	5.14
Haemoglobin Conc (g/dl)	19.01	23.42	20.03	21.08	1.93
Platelet x 10 ³ /mcl	131.00	400.44	200.08	265.00	19.74
Total WBC x 10 ³ /mm ³	9.50	30.04	23.99	19.40	22.38
Differential WBC					
Neutrophil	5.37	14.11	6.55	13.09	14.9
Lymphocytes	1.94	4.20	2.33	3.23	13.1
Monocytes	0.92	2.00	1.02	1.44	12.1
Eosinophils	0.50	1.11	0.74	0.89	1.65
Basophil	0.00	0.01	0.01	0.00	0.00
MCH (pg)	21.06	33.27	25.29	24.66	3.97
MCHC (g/100ml)	29.00	37.01	32.00	33.00	1.51
MCV (fl)	72.08	93.50	80.11	78.49	11.78

Table 3 compared the haematological parameters between male and female new-borns. No significant statistical difference was obtained from both male and female parameters.

**Table 3: Comparison of haematological parameters between male and female subjects**

Parameters	Males n=48	Female n=52	t- value	p- value
RBC million/mm ³	5.25	5.21	0.487	0.701
PCV (hct)%	56.5	58.3	0.598	0.845
Haemoglobin Conc (g/dl)	20.06	21.08	0.356	0.749
Platelet x 10 ³ /mCL	298.00	265.00	3.176	0.09
Total WBC x 10 ³ /mm ³	20.10	19.40	0.401	0.672
Differential WBC				
Neutrophil	13.39	11.09	0.618	0.855
Lymphocytes	4.23	4.11	0.371	0.994
Monocytes	2.44	2.39	0.373	0.989
Eosinophils	0.89	0.89	0.376	0.909
Basophil	0.02	0.00	0.498	0.801
MCH (pg)	26.66	24.16	0.311	0.785
MCHC (g/100ml)	34.00	33.00	0.491	0.768
MCV (fl)	88.44	78.49	1.538	0.08

Red cell indices, RBC count, haemoglobin concentration and PCV are slightly higher several hours after birth because of the movement of plasma from the intravascular to the extravascular space (Keohane *et al.*, 2015). Haematocrit values obtained from this study in males ranged from 50.00 to 62.80% with an average of 56.5 ± 6.04 % and in females 51.06 to 65.10% with an average of 58.3 ± 5.14 %. These values are similar to reports of previous study by Cavaliere, 2004; but higher than values obtained from Zimbabwean neonates 41.8% (Mukiibi *et al.*, 2010).

Haemoglobin concentration count ranged from 18.01 to 23.42g/dl with an average of 20.6 ± 1.93 g/dl and in females 19.01 to 23.42g/dl with an average of 21.08 ± 1.93 g/dl and these values were similar to pre-existing research and fall within values expected in apparently healthy new-borns (Mukiibi *et al.*, 1995).

RBC counts (5.25 million/mm³ for males and 5.21 million/mm³ for females) were relatively higher in our studies at birth which is in agreement with reports from other studies (Henry and Christensen, 2015, Dacie and Lewis, 1991).

Reports on platelet count by (Dacie and Lewis, 1991) revealed that the platelet count during

neonatal periods ranged from 150 to 400×10^3 /mCL and results from our research fall with this range (298×10^3 /mCL for males and 265×10^3 /mCL for females).

Benitz, 2010 reported that the total WBC count at birth ranged from 6000 to 30000 cells/mm³ of human blood. Results from our data fell within this reference range with an average of 20×10^3 cells/mm³ for males and 19.40×10^3 cells/mm³ for females which is also in concordance with earlier reports by Guyton *et al.*, (1996). The differential WBC count revealed that neutrophils was approximately 70% of WBC 13.39×10^3 cells/mm³ for males and 11.09×10^3 cells/mm³ for females. Lymphocytes accounted for 20% of the WBC count 4.23×10^3 cells/mm³ for males and 4.11×10^3 cells/mm³ for females, the monocytes accounted for about 5% of WBCs 2.44×10^3 cells/mm³ for males and 2.39×10^3 cells/mm³ for females while the basophil levels were insignificant.

The haematological indices (MCV, MCH and MCHC) are derived indices calculated from the PCV, RBC count and haemoglobin count. Findings from our data showed that the mean MCV for new-born was 26.66pg for males and 24.18pg for females, mean MCHC 34g/100ml for male new-borns and 33.00g/100ml for female new-borns and the mean



MCV was 88.44 fl for males and 78.49 for female new-borns. This findings is in agreement with reports from previous studies (Dacie and Lewis, 1991; Christensen *et al.*, 2008).

CONCLUSION

Haematological parameters are the constituents of blood and is of utmost important that they must be within normal ranges for proper metabolism in the new-born. Values ranging far below or above the reference ranges are an indication of serious haematological abnormalities or disease conditions such as leucocytosis, haemolytic jaundice in new-born, leucopenia, thrombocytopenia, severe malaria, pneumonia and measles. This study provides values that can be used as reference values for neonates in Nigeria which can aid in early detection, possible prevention and treatment of numerous haematological disorders plaguing new-borns in Nigeria.

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