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Haematological Reference Values for Full term Healthy Neonates Delivered within 24 Hours in Sokoto, Northern Nigeria

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Abstract

Background: The importance of determination of haematological reference values cannot be overemphasized as the changes in some of the blood cell parameters are of clinical importance. The study aimed at determining the haematological reference values in healthy neonates delivered within 24 hours.

Materials and Methods: The study was conducted on 72 healthy, full term neonates (30 males and 42 females) delivered within 24 hours between July and November, 2015 at Usmanu Danfodiyo University Teaching Hospital, Sokoto. Blood samples were analysed for full blood count using haematology analyser (Mythic 22CT, 2008).

Results: The mean values for red blood cell count, haemoglobin concentration, haematocrit, total white blood cell and platelet counts in neonates were $(4.39 \pm 0.59) \times 10^{12}/L$, 14.05 ± 2.01 g/dL, $38.92 \pm 6.75\%$, $(13.46 \pm 4.74) \times 10^9/L$ and $(209.33 \pm 63.15) \times 10^9/L$, respectively. There were no significant differences in the values of red cell, white blood cell and platelet counts between males and females ($P > 0.05$). Lower values of haematocrit and platelet count were observed in this study compared to other reports while the high total white blood cell count in the studied population is in agreement with some previous studies but in contrary with other researchers.

Conclusion: Neonates within 24 hours of delivery are associated with leucocytosis while the haematological values are not influenced by gender in neonates. This study will serve as a guide to the clinicians in the management of neonates in this community and at the same time set a foundation for future studies on the determination of reference range in Northern Nigeria.

Keywords: Haematology; Reference values; Neonates; Northern Nigeria

Introduction

The importance of determination of haematological reference values for full term healthy neonates cannot be overemphasized as the changes in some of the blood cell parameters are of clinical importance[1,2].

Haemoglobin and haematocrit have been used routinely in the diagnosis of neonatal anaemia, which has been associated with morbidity and mortality in neonates[3,4] while white blood cell count in neonates is useful in the assessment of neonatal sepsis but platelet count is used in the evaluation of bleeding disorders[4,5].

Haematological values are affected by sex, gender, race, environment, time and place of sampling[6]. However, in neonates, gestational age, day of life, maternal factors, mode of delivery and site of blood collection can also affect the haematological values[7].

The aim of this study was to determine the haematological reference values in healthy neonates delivered within 24 hours in Sokoto, Northern Nigeria since there is scanty information in Nigeria. It is our hope that the findings in this study will be of diagnostic and therapeutic aids to our neonates in Sokoto and other neighboring Northern states of Nigeria.

Materials and Methods

A cross-sectional study was performed for the determination of haematological reference values in neonates in Sokoto, Northern Nigeria between July and November, 2015.

The study was conducted on 72 healthy full term neonates (gestational age of 37 - 40 weeks and birth weight of 2.5 - 4.0 kg) delivered within 24 hours at the Obstetrics and Gynecology Department of Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto after the ethical approval from the ethnical committee of UDUTH and written consent offered by every mother. A total of 57 newborns had normal vaginal delivery while 15 were delivered by caesarian section.

The inclusion criteria for mothers were ages ranged from 15 - 40 years and haemoglobin concentrations of ≥ 10 g/dL while exclusion criteria were based on mothers with multiple pregnancy, eclampsia, diabetes mellitus, chronic diseases such as heart, kidney or lung diseases, haematological diseases, and healthy full term neonates above 24 hours of delivery.

Two milliliters (2 ml) of venous blood was drawn from every recruited full term neonate delivered within 24 hours and put into Tripotassium Ethylene Diamine Tetra-Acetic Acid (k3EDTA) for the determination of full blood count using automated haematology analyzer (Mythic 22CT, 2008). The haematological parameters studied were Haematocrit (Hct), Red Blood Cell Count (RBC), red cell indices, total and differential white blood cell counts, and platelet count.

Data Analysis

Data were analyzed using statistical software for social sciences (version 20 SPSS Inc.,). The results were expressed as mean ± SD while student's t-test was employed to compare the mean haematological values of females with that of males. P-values less than 0.05 were considered to indicate statistical significance.

Results

Reference values for red cell parameters of healthy full term neonates are summarized in (Table 1). The of red blood cell count, haemoglobin concentration, haematocrit, Mean Cell Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC) and Red Cell Distribution Width (RDW) were $(4.39 ± 0.59)$ x 10^{12}/L, 14.05 ± 2.01 g/dL, 38.92 ± 6.75%, 92.33 ± 4.08 fl, 32.94 ± 2.69 pg, 35.64 ± 2.23 g/dL and 12.08 ± 2.47%, respectively.

Table 1: Reference values for red cell parameters of healthy full term neonates.

Parameter	Mean ± SD (n = 72)
RBC (x 10¹²/L)	4.39 ± 0.59
Haemoglobin concentration (g/dL)	14.05 ± 2.01
Hct (%)	38.92 ± 6.75
MCV (fl)	92.33 ± 4.08
MCH (pg)	32.94 ± 2.69
MCHC (g/dL)	35.64 ± 2.23
RDW (%)	12.08 ± 2.47

White blood cell and platelet counts in healthy full term neonates are shown in (Table 2). The means of White Blood Cell Count (WBC), lymphocytes, granulocytes, monocytes, platelet count, mean platelet volume and platelet distribution width were $(13.46 ± 4.74)$ x 10^9/L, 33.41 ± 11.6%, 56.86 ± 12.65%, 9.9 ± 3.7%, $(209.33 ± 63.15)$ x 10^9/L, 8.23 ± 1.98 fl and 13.68 ± 4.11 fl, respectively.

Table 2: White blood cell and platelet counts in healthy full term neonates.

Parameter	Mean ± SD (n = 72)
WBC (x 10⁹/L)	13.46 ± 4.74
Lymphocytes (%)	33.41 ± 11.6
Granulocytes (%)	56.86 ± 12.65
Monocytes (%)	9.90 ± 3.70
Platelet count (x 10⁹/L)	209.33 ± 63.15
MPV (fl)	8.23 ± 1.98
PDW (fl)	13.68 ± 4.11

(Table 3) shows the gender influence on blood cell count parameters in neonates. The red blood cell parameters in neonates. The red blood cell count was $(4.34 ± 0.66)$ x 10^{12}/L in males compared to $(4.41 ± 0.61)$ x 10^{12}/L in females (P = 0.644), haemoglobin concentration was 13.99 ± 1.82 in males compared to 14.22 ± 2.24 g/dL in females (0.6445), haematocrit was 37.94 ± 8.29% in males compared to 39.69 ± 5.61% in females (P = 0.289), MCV was 91.81 ± 4.7fl in males compared to 93.67 ± 2.45 fl in females (P = 0.032), MCH was 32.93 ± 2.45 pg in males compared to 33.6 ± 2.35pg in females (P = 0.245), MCHC was 35.84 ± 1.94 g/dL in males compared to 35.85 ± 2.15 g/dL in females (P = 0.984) and RDW was 11.76 ± 2.26% in males compared to 12.02 ± 2.30% in females (P = 0.635).

Table 3: Gender influence on red blood cell parameters in neonates.

Parameter	Males (n = 30)	Females (n = 42)	P - value
RBC (x 10¹²/L)	4.34 ± 0.66	4.41 ± 0.61	0.644
Haemoglobin concentration (g/dL)	13.99 ± 1.82	14.22 ± 2.24	0.645
Hct (%)	37.94 ± 8.29	39.29 ± 5.61	0.289
MCV (fl)	91.81 ± 4.70	93.67 ± 2.45	0.032
MCH (pg)	32.93 ± 2.45	33.60 ± 2.35	0.245
RDW (%)	11.76 ± 2.26	12.02 ± 2.30	0.635

(Table 4) reveals the gender influence on white blood cell and platelet counts in neonates. The white blood cell count was $(13.68 ± 5.37)$ x 10^9/L in males compared to $(13.19 ± 4.42)$ x 10^9/L in females (P = 0.673), lymphocytes of 33.23 ± 12.73% in males compared to 34.27 ± 10.82% in females (P = 0.710), granulocytes of 57.08 ± 13.68% in males compared to 55.88 ± 13.68% in females (P = 0.715), monocytes of 9.69 ± 3.35% in males compared to 10.24 ± 14.29% in females (P = 0.553) and platelet count was $(198.34 ± 56.55)$ x 10^9/L in males compared to $(211.03 ± 66.33)$ x 10^9/L in females (P = 0.398).

Table 4: Gender influence on white blood cell and platelet counts in neonates.

Parameter	Males (n = 30)	Females (n = 42)	P - value
WBC (x 10⁹/L)	13.68 ± 5.37	13.19 ± 4.42	0.673
Lymphocytes (%)	33.23 ± 12.73	34.27 ± 10.82	0.710
Granulocytes (%)	57.08 ± 13.68	55.88 ± 13.68	0.715
Monocytes (%)	9.69 ± 3.35	10.25 ± 4.29	0.553
Platelet count (x 10⁹/L)	198.34 ± 56.55	211.03 ± 66.33	0.398

Discussion

The importance of haematological values in neonates in this locality cannot be overemphasized as it helps in the interpretation of test results in the environment, hence, the study on haematological reference values for full term healthy neonates delivered within 24 hours in Sokoto, Northern Nigeria since there was no similar study documented in northern Nigeria.

The mean reference values for red blood cell count and haemoglobin concentration in neonates in this study were similar to the earlier studies[1,8,9] while lower value of haematocrit observed in this study compared to previously reported values of 44 - 48%[1,4,8] may be associated with varying numbers of newborns, time interval between births, ethnic and dietary factors amongst other factors.

The values of MCH and MCHC in the current study are consistent with the earlier findings[2,4,8,10] while lower MCV valued was observed in this study compared to earlier research in Sagamu[4]. This difference may be associated with geographical factors, socio-economic status, maternal factors and iron depletion in women[1,11-13]. The lower RDW value in this study as compared to the findings of other researchers[8,14] may be associated with no significant variation in red cell sizes of the studied population.

The high white blood cell count in our study is in line with the earlier reports[2,9,10] but disagrees with the lower values from some researchers[1,4]. However, total white blood cell count of about 9.0 to 30.0 (x 10⁹/L) in neonates has been associated with physiological process and reaction to various infections and inflammation[15,16].

The values of granulocytes, which are essentially neutrophils, lymphocytes and monocytes in this study are within the ranges of earlier studies[1,4,8,10]. However, neutrophils were more predominant than other white cells in the study and this finding is similar to that of other authors[1,2,4,8,10].

Wide variation of platelet counts in neonates has been reported in different countries[1,2,4,8,9].

However, lower platelet count has been observed in the study compared to previous authors[1,2,4,8,9]. The different platelet counts observed by various researchers may be associated with acute or chronic malaria, environmental factors which may involve the use of medical herbs that are considered to be antiplatelet agents, contamination with wharton jelly, poverty and malnutrition[17]. The values of MPV and PDW in the studied neonates are similar to previous findings in neonates and adults in Mashhad[8,18].

There were no significant differences in the values of white blood cells and platelets in neonates with respect to sex in this study and these findings are in line with the previous reports[1,17,19]. Gender influence on red blood cell parameters in neonates was not observed in this study and this is in agreement with previous findings[1,17,19].

In conclusion, the study has shown that the haematological values of neonates delivered within 24 hours are associated with leucocytosis and there was no gender influence on the blood cell parameters. Since there were no haematological reference values documented for neonates in North-western Nigeria, it is our believe that these findings will serve as guide to the clinicians in this community in the management of neonates and at the same time set a foundation for the future studies that will include appreciable sample size and delivery routes amongst other factors to develop a reference range for Northern Nigeria.

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