

Original Research Article

PREVALENCE OF ANAEMIA AMONG CHILDREN ATTENDING PAEDIATRICS DEPARTMENT OF UDUTH, SOKOTO, NORTH-WESTERN NIGERIA

ABSTRACT

Introduction: Anaemia is defined by the WHO as HB <12g/dl in adult non-pregnant female, Hb < 11g/dl in pregnant females, Hb <13g/dl in adult men, Hb <12g/dl and Hb <11g/dl in male & female children respectively. The aetiological factors of anaemia include; iron deficiency, other micronutrient deficiency, excessive blood loss, inheritance disorders of haemoglobin, malaria and other parasitic infections, HIV- infection and drug treatment-related complications.

Method: Four hundred children aged 0-15years were recruited for this study. Haematological parameters tested include red cell indices, white cell total and differential, platelet counts and morphologies were studied with mythic 5-part autoanalyzer and manual techniques. Malaria testing was done using Parasite-F strip and manual thin film stained with giemsa stain. Other investigations include serum iron, ferritin, transferrin, TIBC, Hb Genotype and HIV testing using rapid strip method approved by WHO.

Result: Out of the four hundred children tested, 139 (34.8%) were anaemic while 261 (65.2%) were non-anaemic. The results revealed five types of anaemia among the children; iron deficiency 59(14.7%), sickle cell 50 (12.5%), normocytic normochromic 20(5%), anaemia of chronic diseases 9(2.2%) and megaloblastic 5 (1.3%).

Conclusion: This study observed the prevalence of 34.8% of anaemia among our cohort of children aged 0-15 years, attending the Paediatrics Departments of Usmanu Danfodiyo University Teaching Hospital, Sokoto, North-Western Nigeria. There is need for the provision of iron and other micro nutrient supplementation for children particularly those with anaemia in the area.

Key Words: Anaemia, Prevalence, children, Paediatrics Department, UDUTH, Sokoto.

INTRODUCTION

Anaemia is a global public health problem. It is associated with a decrease in the haemoglobin concentration with a consequent decrease in the haematocrit (PCV) level. Anaemia is defined by the WHO as Haemoglobin (HB) <12g/dl in adult non-pregnant female, Hb < 11g/dl in pregnant females, Hb <13g/dl in adult men, Hb <12g/dl in male children, Hb <11g/dl in female children and Hb < 13g/dl in newborn [1]. Anaemia affects more than 56 million people globally, two thirds of them being from developing countries [2]. The aetiological factors of anaemia are

multi-factorial and include; iron deficiency, other micronutrient deficiency, excessive blood loss, inheritance of the disorders of haemoglobin synthesis, malaria and other parasitic infections (hookworm and schistosomiasis infestations), HIV- infection and drug treatment-related complications [3]. Among the numerous factors; both nutritional and non-nutritional that contributed to the onset of anaemia, iron deficiency and malaria play an important role [4]. Anaemia is a common clinical problem encountered among the under-fives in everyday paediatric practice. Anaemia is typically diagnosed on a complete blood count. Apart from reporting the number of red blood cells and the haemoglobin level, the automatic counters also measure the size of the red blood cells by flow cytometry, which is an important tool in distinguishing between the causes of anaemia. Examination of a stained blood smear using a microscope can also be helpful, and it is sometimes a necessity in regions of the world where automated analysis is less accessible. In modern coulter counters, four parameters (RBC count, Hb concentration, PCV and RDW) are measured, allowing others (MCV, MCH and MCHC) to be calculated, and compared to values adjusted for age and gender. Other diagnosis required for proper differential diagnosis of anaemia include; malaria testing, haemoglobinopathies (using electrophoresis at alkaline pH), serum transferrin, serum iron and total iron binding capacity [5].

Severe anaemia is a major paediatric problem in Nigeria [6]. It is associated with many unwanted effects on the patient, such as, congestive cardiac failure, chest pain, jaundice, splenomegaly, joints pain, fever, swelling of the limbs etc. Severe anaemia which is a life threatening condition is a common occurrence in children emergency units in most hospitals in developing countries and most anaemia related -deaths encountered are usually due to severe anaemia. It is a common blood disorder in children and imposes an economic burden on the parents/caregivers and the country as a whole. Majority of anaemic children (76.2%) are under the age of 5 years, the most frequently affected age is 2 years (23.8%) with a male to female ratio was 1:2 [7]. In various African settings, about 12 to 29% of hospitalized children have severe anaemia with hospital case fatality rate ranging between 8 and 17% [8]. Serum ferritin has been the most commonly used single laboratory parameter to discriminate between ACD and IDA [9]. Nemeth and Ganz, 2006, developed and validated the first very sensitive and easily done serum enzyme linked immunoabsorbent assay for serum ferritin, which can be used reliably to diagnose anaemia.

MATERIAL AND METHODS

STUDY AREA

This study was carried out in Paediatrics Department of Usmanu Danfodiyo University Teaching (UDUTH) Sokoto, North-Western Nigeria. Sokoto State is located in the extreme North- West of Nigeria, near to the confluence of the Sokoto River and the Rima River. The State is located between longitude 11°30', 13°50' East and latitude 4° to 6°0' North. It is bordered to the North by Niger Republic, Zamfara State to the East while Kebbi State borders most of the South and Western parts [10]. The State falls within the Savannah vegetation zone. Rainfall starts late and ends early with mean annual rainfall ranging from 500 to 1,300 mm, and annual average temperature of 28.3°C(82.9°F). It has a land area of about 28,232.37sq kilometres and stands at altitudes of 272m above the sea level. The State has three peculiar seasons; the cold dry (December-February), hot dry (October-April) and wet. The wet season begins in most part of the State in May and lasts up to September. The vast Fadama land of the Sokoto Rima River system dissects the plain and provides rich alluvial soil and extensive grassland fit for a variety of crop cultivation, hence farming and livestock rearing are the principal activities in the State. Other commercial activities are cement and leather production. The major indigenous tribes in the state are the Hausa and Fulani and other groups such as Gobirawa, Zabarmawa, Kabawa, Adarawa, Arawa, Nupes, Yorubas, Ibos and others. Occupation of city inhabitants include trading, commerce, with a reasonable proportion of the population working in private and public sectors. Majority of the Hausas' are farmers while Fulanis are nomadic and are engaged in animal rearing [11]. Based on 2006 population census, Sokoto State had a population of 3,696,999 [12], with an average estimate of 4,806,098 in 2015 based on the population annual growth rate of 3% [13].

STUDY POPULATION

A total of 400 children aged 0-15 years with mean age 5.273 ± 4.63 years whose parents offered a written informed consent for their wards to participate in the study were recruited for this prospective cross-sectional and descriptive study. The subjects were recruited from Paediatrics Department of Usmanu Danfodiyo University Teaching Hospital, Sokoto, North- Western Nigeria. The age of 15years is considered as the limit for Paediatrics patients in UDUTH, Sokoto [14].

STUDY DESIGN

This is a prospective cross-sectional and descriptive study designed to investigate the prevalence and the types of anaemia among 400 children attending Paediatrics Wards of Usmanu Danfodiyo University Teaching Hospital, Sokoto, North- Western Nigeria. Whole blood samples from the subjects were tested for full blood count, malaria parasites, blood film reports, Hb electrophoresis. Serum sample was tested for serum iron, total iron binding capacity, serum transferrin, serum ferritin and HIV screening.

This study was approved by Ethical Committee of Usmanu Danfodiyo University Teaching Hospital, Sokoto (Approval attached under appendices) and written informed consent was obtained from the parents of all participants in this study.

STATISTICAL ANALYSIS

The data collected were entered into the data editor of statistical package for social sciences (SPSS Version 20) software. Analysis was based on simple percentages, proportions and values were expressed as Mean $\pm$ SD. A Chi-square test at a 95% confidence level was also used to test for association between aged groups, anaemia and gender. A p-value of ≤ 0.05 was considered as significant in all statistical analysis.

RESULTS

Table 1: Mean Values and Standard Deviation of the Haematological Variables.

Four hundred subjects comprising 224(56.0%) male and 176(44.0%) female aged 0-15 years were used for this study. The children include; pre primary school (0- 5.00 years), primary school (5.0001- 10.00 years) and post primary school (10.0001- 15.00 years). The mean values and standard deviation of the haematological and biochemical parameters were also showed below.

Variable	Mean $\pm$ Std
Age	5.273 $\pm$ 4.63

Haemoglobin (g/dl)	11.12 ± 2.51
Packed Cells Volume (%)	33.3 ± 7.99
Red Blood Cells (x 10¹²/l)	3.81 ± 0.82
Total Leucocytes Count (x 10⁹/l)	9.20 ± 6.89
Platelets count (x 10⁹/l)	310.6 ± 136.7
Serum Iron (ug/dl)	82.59 ± 31.55
Serum Ferritin (ng/ml)	56.66 ± 27.92
Serum Transferrin (mg/dl)	253.72 ± 82.81
Total Iron Binding Capacity (mg/dl)	304.3 ± 99.60
Mean Cells Volume (fl)	88.28 ± 12.41
Mean Cells Haemoglobin (pg)	28.72 ± 4.38
Mean Cells Haemoglobin Concentration (g/dl)	32.39 ± 15.39
Red Cells Distribution Width (%)	16.62 ± 7.35

This table shows the Mean Values and Standard Deviation of the Haematological variable, iron and iron related/biochemical parameters. From the general view, they appear relevant and appropriate to the requirement of our manipulation. STD = Standard Deviation, g/dl = gram/decilitre, % = percent, X= multiply Ug = microgram, ml = millilitres, mg = milligrams, fl = fentolitres, pg = picogram, l = litre.

Table 2: Age and Gender Distribution of the Study Population.

This research work examined the haematological, iron and iron-related parameters of four hundred children attending Paediatrics Department of UDUTH, Sokoto, North-western Nigeria. Out of the four hundred children tested, 224(56%) were male while 176(44%) were female. The children include; pre primary school (0-5.000 years), schooled (5.0001-10.000 years) and post primary school (10.0001-15.000 years) as shown below.

Gender			
Age (years)	Male	Female	Total
0 – 5.000	126(31.5%)	102(25.5%)	228(57.0%)
5.1 – 10.000	62(15.5 %?)	35(8.8%)	97(24.3%)
10.1 - 15.000	36(9.0%)	39(9.7%)	75(18.7%)
Total	224(56%)	176(44.0%)	400(100.0%)

129 This table indicates the characteristics age and gender distribution of the total study population. These are the total
 130 study used in this study. $X^2 = 4.47$; $df = 2$ p-value = 0.107 df = degree of freedom.

131 **Table 3: Prevalence of Anaemia among the Study Population.**

132 Of the four hundred children tested, 139 (34.8%) children were anaemic while 261 (65.2%) were
 133 not anaemic (normal) as shown in table 3 below. Children aged 0-5.00 years are more affected
 134 with anaemia compared to those above 5.00 years

Age (years)	Not anaemic	Anaemic	Total
0 – 5.000	154(38.5%)	74(18.5)	228(57.0%)
5.1 – 10.000	59(14.8%)	38(9.5%)	97(24.2%)
10.1 – 15.000	48(12.0%)	27(6.8%)	75(18.8%)
Total	261(65.2%)	139(34.8%)	400(100%)

135 The overall prevalence of 139 (34.8%) of anaemia was observed among the children attending UDUTH, Sokoto,
 136 North-Western Nigeria ($X^2 = 1.42$; $df = 2$ p-value = 0.500). Linear by linear association ($X^2 = 0.684$; $df = 1$, p-
 137 value = 0.038, $df =$ degree of freedom).

138 **Table 4: Severity of Anaemia among the Study Population.**

139 Children whose PCV ≥ 31 were considered not anaemic, mild anaemic children had PCV of 28 –
 140 30% while severe anaemic children had PCV of $< 20\%$ as indicated below.

Degree of Anaemia					
Age (years)	Not Anaemic	Mild A.	Moderate A	Severe A.	Total
0 – 5.0	154(38.5%)	32(8.0%)	34(8.5%)	8(2.0%)	228(57.0%)
5.1 – 10.0	59(14.8%)	8(2.0%)	22(5.5%)	8(2.0%)	97(24.3%)
10.1 – 15.0	48(12.0%)	6(1.5%)	17(4.2%)	4(1.0%)	75(18.7%)
Total	261(65.3%)	46(11.5%)	73(18.2%)	20(5.0%)	400(100%)

141 This table has assessed the severity of anaemia in the total population and indicates that children aged 0-5.00 years
 142 are more severe than those above 5.00 years. $X^2 = 9.7$; $df = 6$, $p\text{-value} = 0.133$, $df = \text{degree of freedom}$. A =
 143 Anaemia.

DISCUSSION

Anaemia in this study was defined based on the WHO criteria of haemoglobin values of less than 11g/dl; mild anaemia (9.0–10.9 g/dl), moderate anaemia (7.0–8.9 g/dl) and < 7.0 g/dl (severe anaemia). The global prevalence of anaemia in school-age and preschool-age children is 25.4% and 47.4% respectively. It affects 293 million children globally with the highest prevalence found in Africa (67.6%) [15].

Four hundred subjects comprising 224(56.0%) male and 176(44.0%) female were used in this study. Out of four hundred children tested, 139 (34.8%) children were anaemic as shown in table 3. A total of 16 (4%), 103 (25.8%) and 20 (5%) children had mild, moderate and severe anaemia respectively while 261 (65.2%) were not anaemic (normal) as indicated in table 4. The mean values and standard deviation of the haematological and biochemical parameters were also showed in table 1. The tests performed on iron and iron related biochemical parameters were haemoglobin (Hb) concentration, packed cell volume (PCV), serum iron (SI), total iron binding capacity (TIBC), serum ferritin (SF), serum transferrin (TS), mean cell volume, mean haemoglobin concentration mean cell haemoglobin concentration and red cell distribution width. As shown in table 4, the mean values obtained for haemoglobin concentration, packed cell volume, serum ferritin (SF), serum iron (SI), total iron binding capacity (TIBC), serum

transferring (TS), mean cell volume (MCV), mean haemoglobin concentration (MCH), mean cell haemoglobin concentration (MCHC) and red cell distribution width (RDW) of the anaemic children were; 11.12 ± 2.51 g/dl, $33.3 \pm 7.99\%$, 56.66 ± 27.92 ng/ml, 82.59 ± 31.55 ug/dl, 304.3 ± 99.60 ug/dl, 253.72 ± 82.81 g/dl, 88.22 ± 12.41 fl, 28.72 ± 4.38 pg, 32.39 ± 15.39 g/dl and $16.62 \pm 7.35\%$ respectively. Our observation is consistent with the average MCV in IDA of 66.81 fl, the mean value of MCH of 23.97 pg, mean value of MCHC of 34.81%, and mean haemoglobin of 10.41 gm/dl in IDA recorded by Abu-syed *et al.*, 2014 [16]. These observations are also similar to the report by Bainton *et al.*, 1971 [17]; which showed a mean MCV, MCH, MCHC and haemoglobin of 74 fl, 20 pg, 28% and 7.6 gm/dL respectively in patients with IDA [18].

In this study, we recorded an overall prevalence of anaemia of 34.8% among our cohort of children in Sokoto, North Western Nigeria. This finding is consistent with the global prevalence of 33% [19]. Our observed prevalence is however lower compared to the local findings which recorded high prevalence rate of anaemia of 49.6% in children in South Eastern Nigeria [20]. Similarly, our observed prevalence among children in Sokoto is also lower compared to the high prevalence of 82%, 62%, 66.7% and 57.1% reported in Abia State [21], Ibadan [22], Anambra State [23] and Enugu [24] respectively. The low prevalence observed in our study may be linked to the fact that this present study was carried out in Usmanu Danfodiyo University Teaching Hospital where a significant number of patients seen are in the higher economic class and have access to better nutrition. They are also more likely to be able to afford insecticide- treated mosquito bed nets and thus are less exposed to malaria and malaria-related anaemia. This may also be linked to the facts that the study was conducted between March to June, 2015(dry session) when there is climatic changes and the environment is not conducive for the breeding of female anopheles mosquitoes (causative agent of malaria). In this present study, we observed prevalence of severe anaemia, mild anaemia and moderate anaemia of 20(14.4%), 64(46.0%) and 55(39.6%) respectively among our cohort of children in Sokoto, Nigeria. Our observed prevalence varies slightly from prevalence of severe anaemia, mild anaemia and moderate anaemia of 16.7-22.2%, 13.9% and 8.3% respectively observed in a previous report in North Western Nigeria [25].

However, our observed prevalence is higher than a 29% prevalence of anaemia reported in Katsina [26]. Several factors may be responsible for the high prevalence of anaemia among children recorded in our study and in other studies from other parts of Nigeria. These include; malaria, poor nutrition, frequent bacterial infections, poor hygiene and high parasitic infections, etc [27]. Our study is also consistent with the prevalence level for developing countries recorded to be 42% for pre-school children but inconsistent with 53% of anaemia recorded previously for school children in developing countries. This may be due to poor nutrition, mal-absorption, poor environment or poor socio-economic background.

In this study, we observed an overall prevalence of 14.7% of iron deficiency anaemia among our study population. According to WHO criteria, the accepted cut-off point for iron deficiency anaemia screening in children is set at 11gm/dl, 70fI and 20pg for haemoglobin, MCV and MCH respectively. Following these criteria, the most common type of anaemia recorded among the children in this present study is iron deficiency anaemia, followed by sickle cell anaemia 12.5%, normocytic normochromic anaemia 5.0%, anaemia of chronic diseases 2.3% and macrocytic/megaloblastic anaemia 1.2%. The findings from this study is lower compared to the finding in a study done in Ibadan, Nigeria, where iron deficiency anaemia was recorded among 31.5% of children aged between one and ten years, attending University College Hospital Ibadan [28]. Our finding is also lower compared to the prevalence rate of 34.3% reported in Enugu South East Nigeria by Ekwochi *et al.*, 2014. The higher prevalence recorded in the previous studies may be linked to the facts that some children in this area are malnourished. Other factors may include; inadequate intake of iron containing food, mal-absorption from the gastro-intestinal tract and excessive loss from the circulation. Also prevalence of iron deficiency anaemia in children was higher in male compared to female. The prevalence of iron deficiency anaemia declined sharply in males after 16 years of age coinciding with the end of a growth spurt while the prevalence among females stated to rise after the age 18 years as they proceed to marriage and childbearing [29].

CONCLUSION

Generally, there is high prevalence of anaemia among the children in Sokoto (34.8%), and iron deficiency anaemia is the highest, followed by sickle cell, normocytic normochromic, anaemia of chronic diseases while megaloblastic anaemia is the least. Serum iron and ferritin levels, as measured by ELISA can be reliably used for the differential diagnosis of iron deficiency anaemia (from other anaemia) among children. There is need for the provision of iron and other micro nutrient supplementation for children particularly those with anaemia in the area.

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APPENDIX I

USMANU DANFODIYO UNIVERSITY TEACHING HOSPITAL, SOKOTO.

PRIVATE MAIL BAG 2370 SOKOTO, NIGERIA

Chairman Board
Rt. Hon. Inusa Simon Dogari

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UDUTH/HREC/2014/292

25th February, 2015

Our Ref:

Your Ref:

Date:

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RE: APPLICATION FOR ETHICAL CLEARANCE

With reference to application on the above subject dated 31st December, 2014 on a research topic titled: *"Aetiology and types of Anaemia among Children visiting Paediatrics Department of Usmanu Danfodiyo University Teaching Hospital, Sokoto, North-western Nigeria"*, I write to acknowledge its receipt and to convey Ethical Committee's approval to you. The approval is given with the understanding that the data obtained would be used to substantiate the above topic.

Please ensure that the study is guided by the methodology presented in the proposal.

Thank you.

Prof. Nma M. Jiya, *FWACP*
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