PREVALENCE OF ANEMIA IN CHILDREN 6 TO 59 MONTHS OF AGE IN GADAREF STATE, SUDAN -2013

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ABSTRACT

Background: *Anemia is a condition characterized by reduction in thevolume of red blood cells and a decrease in the blood concentration of haemoglobin (less than 11gm/dl). Haemoglobin is a main part of red blood cells and binds oxygen. This can lead to range of adverse symptoms. The most common cause of anemia worldwide is an iron deficiency. This study attempted to estimate the prevalence of anemia among children 6 to 59 months of age in Gadaref State, and to determine the related factors, which include socio demographic factors and nutritional status of children.*

Patients and Methods*: A total of 384 children 6 to 59 months of age wereincluded in this cross sectional (community based) study in Gadaref State. The data was collected by interviewing mothers through questionnaire, clinical examination, and blood examination. Data was analyzed by the computer using SPSS.version16. Chi-Square test was used for testing significance. P=0.05 or less was considered statistically significant.*

Results: *Forty eight percent of children were anemic; there is a significantrelation between anemia and nutrition of children in this age. Malnutrition was related to anemia in the affected children; 35.1 % of anemic children had mild malnutrition, 23.8% and17.3% had moderate and severe malnutrition subsequently. Social factors related to anemia in children in Gadaref State are: family income, size of the family and mother education.*

Conclusion *The prevalence of anemia in children 6 to 59 months of age InGadaref State is high. It is more frequent in the age group of 23 months to 59 months; females are affected more than males. There is an association between anemia and nutritional status of children.*

Key Words: anemia*, prevalence and risk factors.*

INTRODUCTION

Anemia is a condition characterized by reduction in the volume of red blood cells and a decrease in the blood concentration of haemoglobin in the blood. A reduction in the volume of red blood cells in the blood decreases the amount of oxygen reaching the tissues and organs of the body, causing a range of adverse symptoms.

(Brabin BJ, 2001). It continues to be a major public health problem worldwide. (World Health Organization 2001).

In preschool age children, anemia is associated with high risk of death and impaired cognitive development, growth, and immune function. (Baker RD, Greer FR, 2003)

According to estimates from the World Health Organization, two billion individuals suffer from anemia in the world (World Health Organization 2001).

The highest prevalence of anemia exists in the developing world where its causes are multi-fact-orial, ranging from micronutr-ient deficiencies such as iron, folate, vitamin B12 and to infec-tious diseases such as malaria and worm infestation Yip R, Ramakrishnan 2002) and (Maramag CC,, 2010). In sub-Saharan Africa, 83.5 million children were anemic representing two-thirds of all children.

In Sudan the prevalence of nutritional anemia in children less than 10 years of age is 63% (Harm Omer El, 2009).

In Gadaref Teaching Hospital: 877 cases were diagnosed as anemia in the pediatrics Hospital in 2011, constituted 20% of all admission. Sickle cell anemias were 286 cases. Reports revealed 30 deaths related to anemia in the same year. (Statistic department in Gadarif, 20011)

Iron deficiency is responsible for about 50% of cases of anemia in young children and pregnant women in developing countries. (Maramag CC,, 2010).

Socio demographic factors which include (family size, family income, types of housing, father occupation and mother education) have association with anemia in children.(World Health Organization. The World Health Report 2005:).

Nutritional anemia is common among families of low socio economic status. (World Health Organization. The World Health Report 2005). Altho-ugh this nutritional deficiency can affect all socioeconomic str-ata, anaemia is more prevalent among the underprivileged classes.(Karen J.2011).

Anemia can be classified based on the size and haemoglobin content of the cells to four types:

1. **Hypochromic, microcytic:** The most common cause of this type is iron deficiency anemia and thalassemia; [11].

2. **Normochromic, Normocytic:** Chronic inflammatory diseases, infections, malignancy, marrow aplasia and chronic renal failure.
3. **Macrocytic:** includes vitamin B12 deficiency, folate deficiency, hypothyroid-i-sm, chronic liver disease, Down syndrome, marrow failure and alcohol. [11].
4. **Hemolytic disorders:** like Hemoglobinopathies and Auto Immune haemolytic anaemia. [12].

Patients and methods

1. Study design

Cross sectional, community based study.

2. Study area

Gadaref State is located in Eastern Sudan. It has an area of 75,263 km² and an estimated population of approximately 1,400,000. Gadaref City is the capital of the state. It includes 12 localities: Gadaref, Wasat Algadaref, Alfao, Albutana, Alrahad, Alfashaga, Algallabat Alshargia and Algallabat Algarbia, Basonda, Gala Alnahal, Almafaza and Algoreasha. [13].

3. Study population

All children of 6 to 59 months of age from both sexes in Gadaref state are included.

Inclusion criteria: Those who were resident in Gadaref and Wasat Algadaerflocality (55,326 children).

Exclusion criteria: All children who came from outside the area during thestudy as well as visitors from outside the area.

4. Sampling:

Sample type and technique:

- Gadaref locality was selected purposively due to its importance as a capital and because it is over populated and Wasat Al Gadaref locality was selected by simple random sampling from the other 11 localities.
- The study area (all quarters and villages of Gadaref locality and all villages of Wasat Al Gadaref locality) was included in the study. Sixteen clusters were taken by simple random sampling.
- So according to the population size in each locality: 11 clusters were selected in Gadaref locality and 5 clusters in Wasat Al Gadaref locality. Every selected cluster represents one quarter or one village.

According to the geographical directions, every cluster was divided to 4 sub clusters (North, South, East and West). From each sub cluster 6 children were selected randomly from 6 households by using simple random sample. Random selection of one child has been used for households which involve more than one child of the age (6 to 59 months).

5. Sample size

According to the following formula, sample size was drawn:-

$= \frac{z^2pq}{d^2}$

n = Sample size
z = Standard normal deviate = 1.96
p=Proportion of the characteristic under study estimated in the target population = 0.63
q = 1-p = 0.37
d = Error allowed = 0.05
nr = non response rate taken as 0.07
Sample size =358 taken as 384.

6. Data collection:-

Variables:

Socio demographic factors: age, sex, residences, family members, family income, mother education and father occupation.

Child nutrition: breast feeding, exclusive breast feeding, number of meals and type of meals.

Z score (weight for height)
Clinical examination of the child,
Blood investigation (Hb concentration. gm/dl, type of anemia and sickling test) were done.

8. Tools of data collection

Questionnaire:

The children's mothers were interviewed through clo-sed ended questionnaires about the socio demographic factors which include: age, sex, residence, family members, father occupation, family income, and mother education. Also they have been asked about child's nutrition, which included breast-feeding, number and type of meals. (See the annex).

Clinical examination:

By examining the general condition of the child and assessing nutritional status by using weight for height according to WHO standard (after measuring weight and height). Three standard deviations were used (z-score). In this standard: normal weight for height of the child is mention in the chart (ave-

rage). So if the child reading was less than one z-score that means it is mild wasting, less than second z-score means moderate and three z-score means severe wasting.

Assessment of Hematological level:

Hb estimation:

- 2cc of blood were withdrawn from cephalic or median cubital vein of every selected child into EDTA vacutainer. Inverting five to six times immediately after drawing the blood gently mixed the tube. Then the tube was put in the Sysmex automated hematology analyzer to give automatic result of Hb, MCV, MCH and MCHC.

Sickling test to detect sickle cell anemia (HBS or HBAS) was done for all anemic children. This test was done by mixing 2 drops of blood with sodium metabisulfite (reducing agent) which induced sickling in susceptible cells. After twenty minutes and through microscope: the normal RBCs morphology would not change (negative results), On the other hand abnormal RBCs morphology (crescenteric or pointed shape) indicated positive result. The cut-off point for anemia was these recommended by the WHO: 11.0g/dL for children 6-59 months of age. From these results: anemic children were classified to four types: microcytic hypochromic as Iron deficiency (because thalassemia had not been reported among Sudanese people), normocytic normochromic, Sickle cell anemia and macrocytic (megaloblastic). [11].

9. Data analysis:

Data was analysed by the computerusingSPSS.Version-16.Descriptive statistics was used to describe variables. Chi-square test was used for testing significance. P value= 0.05 or less was considered statistically significant.

10. Ethical issues

- Ethical clearance was obtained from Sudan Medical Specializations Board and the ethical committee of Gadaref State Ministry of Health.
- Informed consent from all participants' mothers was obtained.
- Privacy of data and information was considered in this research.

Results:

Table-1
Sociodemographic characteristics of anemic children (6 to 59) months of age in Gadaref State, Sudan, 2013, (n =185).

Socio demographic characteristic			Percent
Age	6 - 11 months	33	17.8
	12 - 23 months	59	31.9
	24 – 59 months	93	50.3
Gender	Female	99	53.5
	Male	86	46.5
Owning house status	Own house	153	82.7
	Rented house	32	17.3
Family members	2 to 3	24	13.0
	4 to 5	74	40.0
	more than 5	87	47.0
Father Occupation	Employee	65	35.2
	Farmer	73	39.6
	Merchant	24	13
	Others	23	12.2
Family income	Less than 300 SDGs	54	29.2
	between 300 to 650 SDGs	80	43.2
	more than 650 SDGs	51	27.6
Mother Education	Illiterate	47	23.3
	Basic school	90	48.6
	Secondary school	48	28.1
	Total	185	100%

From Table (1), regarding the socio demographic characteristics of anemic children that was statistically associated with anemia in this study: 50.3% of anemia occurred in the age 24 to 59 months, followed by 31.9% in the age 12 to 23 months and 17.8% in the age 6 to 11 months. 53.5% of anemic children were females and 82.7% live in their own houses. 47% of family members of anemic children were more than five, 40% were 4 to 5 individuals and 17% were 2 to 3individuals. Concerning father's occupation of anemic children, 39.6% were farmers, 35.2% were employees and 13% were merchants. Regarding family income: 43.2% between 300 to 650 Sudanese pounds, 29.2% less than 300 Sudanese pounds and 27.6 more than 600 Sudanese pounds. The level of education of 48.6% of the mothers of anemic children was basic school, 28.1% secondary school and 23.3% were illiterates.

Table-2
Relation between anemia and nutrition in children (6 to 59) months of age in Gadaref State, Sudan, 2013 (n=384).

		Present		Absent				
		No.	**%**	**No.**	**%**			
Breast feeding in	Yes	114	41.9	158	58.1	272	(70.8%)	
children 6 to 59	No	71	63.4	41	33.6	112	(29.2%)	0.002
months of age	Total	185	66.9	199	33.1	384	(100%)	
Exclusive breast	Yes	79	44.9	97	55.1	176	(45.8%)	
feeding in the first	No	106	51.0	102	49	208	(54.2%)	0.39
6 months of life	Total	185	100	199	100	384	(100%)	
Number of meals	Less than 3	65	90.3	7	9.7	72 (18.8%)		
	3 – 5	117	41.2	131	52.8	248 (64.6%)		0.000
	More than 5	3	4.7	61	95.3	64 (16.7%)		
	Total	**185**	**100**	**199**	**100**	**384 (100%)**		

From Table (2), regarding breast feeding: 41.9% of childr-en on breast feeding were an-emic, while 63.4% of children who were not on breast feeding were anemic. Among the 176 children underwent exclusive breast feeding during the first 6 month of their life, 44.9% of them were anemic and 55.1% were notanemic. The results showed that 51% of children who didn't undergo exclusive breast feeding were anemic.

Concerning number of daily meals, 90.7% of children who eat less than 3 meals per day were anemic, 42.2 of children who eat 3 to 5 meals were anemic and 4.7% of children who eat more than 5 meals were anemic.

Table-3
Relation between anemia and nutritional status of children (6 to 59) months of age in Gadaref State, Sudan, 2013 (n=384).

Nutrition		Anemia				Total	P value
		Present		Absent			
		N0	%	No	%		
Nutrition status	Average	44	35.8	79	64.2	123 (32.1%)	0.003
(weight for height)	Mild wasting	65	53.7	56	46.3	121(31.5%)	
	Moderate Wasting	44	50.0	44	50	88 (22.9%)	
	Sever wasting	32	61.5	20	38.5	52 (13.5%)	
	Total	**185**	**100**	**199**	**100**	**384 (100%)**	

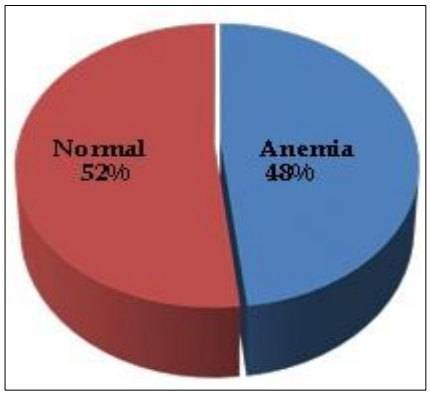
From Table (3), concerning nutritional status (weight for height), 35.8% of overall normal children in this study were anemic. 53.7% of mild malnourished, 50% of moderate malnourished and 61.5% of severe malnourished were anemic.

Table- 4
Types of meals in anemic children 6 to 59 months of age in Gadaref State, Sudan, 2013 (n=185)

Types of meal	Frequency	Percent
Legumes	65	35.1
Biscuits and juice	55	29.7
Milk	16	8.6
Milk & porridge	10	5.4
Milk, porridge and meat	10	5.4
Eggs	9	5
Vegetables	7	3.8
Porridge	6	3.2
Others	7	3.8
Total	**185**	**100%**

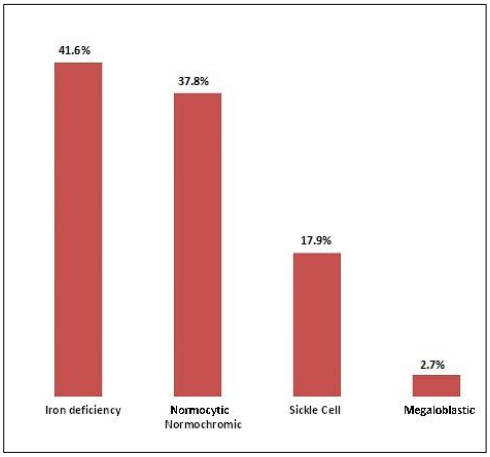
From Table (4), Regarding types of daily meals in anemic children, legumes constitute 35.1%, biscuits and juice 29.7%, milk 8.6% and milk, meat and porridge (5.4%).

Figure-1
The prevalence of anemia in children (6 to 59) months of age in Gadaref State, Sudan, 2013 (n=384)



It is obvious that the prevalence of anemia was high (48%). The mean HB level concentration of anemic children was 9.3 gm/dl. (SD±1.25).

Figure-2
Types of anemia in children 6 to 59 months of age in Gadaref State, Sudan, 2013 (n=185)



With regard to types of anemia in this research, 41.6% of anemic children were classified as iron deficiency anemia, 37.8% as normocytic normochromic anemia, 17.9% as sickle cell anemia and only 2.7% as megaloblastic anemia.

Discussion:

The prevalence of anemia in this study is 48%. This result is similar to the WHO estimation of anemia in Africa, which estimated the prevalence of anemia among preschool children ranging from 47.5% to 67.6% [9]. According to nutritional survey in Sudan, the rate of nutritionalanemiain malnourished children was 63%. (Harm Omer El.2011).

In this research anemia was classified to four types: Microcytic hypochromic, Normocytic normochromic anemia, SCA and megaloblastic anemia. The differential diagnosis of microcytic, hypochromic anemia is iron deficiency anemia and thalassemia (which had not been reported in Sudan) (Harm Omer El.2011). So IDA is more frequent among anemic children (41.6%) and this is similar to WHO studies, which mentioned that 50% of cases of anemia are due to Iron deficiency. (World Health Organization 2001).

Normocytic normochromic anemia represents 38.8%, which can be due to infections like malaria or due to chronic inflammatory disease.

Sickle cell anemia in this study was 17.9% of all cases. In 2011 the admission of SCA was about 30% of all admissions of anemic children. (**Statistic department in Gadarif, 2011).**

Megaloblasic anemia, which is usually due to folic acid deficiency or vitamin B12 deficiency, is not common in Gedaref State (about 2.7% of anemic children). This can be explained by that the majority (70%) of children in this research underwent breast feeding which can give their body a sufficient storage of folic acid Statistic department in Gadarif.

IDA was more frequent in infants (6 to 11 months of age), it represents 57.6% followed by 50.8% in the age (12 to23 months). This can explain deficiency of iron in children under 2 years, which represent the period of supplementary feeding with lactation. This result is nearly similar to findings of study in western Africa which showed that the prevalence of IDA in under 2 years old children is 45%.[(Stoltzfus RJ. 2005).

Normocytic normochromic anemia is common in the age 24 to59 months (45.2%), which can be due to malaria or other infections. In Sudan, 54.1% of patients with malaria are anaemic (.Mohammed F2011).

No significance difference in prevalence of anemia in both sexes. However, it is a little bit more frequent in females (54%).

The majority of all children under the study live in their own family houses. So status of owning house has no impact on anemia in this study.

Establishment of nutritional deficiencies is linked to the population's socioeconomic conditions. (Osório MM, 2004). Thus, the association found between large family members (more than five), low family income and anemia among children in this research corporate other studies in Brazil and in other countries that have indicated that there is an inverse association between families' purchasing power and the prevalence of anemia among children.

The association between mothers'schooling level and the care provided for children is important, given that education

has a relationship with the capacity to grasp the knowledge needed for adequate healthcare and nutrition for children, just it provides a chance to enter the labor market and probably better socioeconomic conditions.[17] The results from the present research reflect this relationship, through showing that 63% of anemic children's mothers are illiterate or stopped learning in the primary school.

Concerning types of meals legumes and sweets constitute 65% of anemic children food, while 15 % of them depend on milk and meat. This can explain the nutritional (iron deficiency) anemia among these children.

There is a significant association between anemia and nutrition in this research. Breastfeeding has a significant association with HB concentration Also number of daily meals has strong association with anemia (P value 0.001). About third of anemic children eat less than 3 meals per day. So this can explain their low HB. Weight for height has been used (Z score) to assess the nutritional status of children in this research. It revealed a significant association between anemia and malnutrition (P value 0.003). Mainly 23.8% are average weight for height. Otherwise, they range from mild (35.1%) to moderate (23.8%) and severe wasting (17.1%). In 2009 a nutritional survey was conducted in Sudan, 63% of malnourished children was anemic (**Harm Omer El 2004).** A similar study was conducted in Nigeria to determine the association between anemia and nutritional status of preschool children based on under weight and stunting (i.e. Weight for age and Height for age, respectively). 36% of the anemic children were stunted, 18.3% wasted and 44.2% underweight. Underweight was the most prevalent form of malnutrition, while the most severe form was stunting. [18],[19].

Conclusion:

The prevalence of anemia in Gadaref State is high. It is more frequent in the age group of 23 month to 59 months; females are affected more than males. The most common type of anemia is iron deficiency anemia.

The prevalence of Sickle cell anemia is high.

There is association between anemia and nutritional status ofchildren.

Social factors related to anemia in Gadaref State are: family income, size of the family and mother education.

Recommendations:

Raise awareness of wom-en about child nutrition and the importance of regular nutritional assessment of their children in PHC centers.

Increase awareness of the community and families about anemia in Gadaref State.

Strengthening of IMCI and school health programs in the state and improve family income.

Iron supplementation is advised to be given to pregnant women and children.

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