The prevalence of anemia among preschool Sudanese children in Wad Medani Great Locality, Gezira State, Sudan

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ABSTRACT

Background: Anaemia is a major child health problem worldwide. The prevalence among preschool children is relatively high in developing countries. The objectives of this study were to determine the prevalence of anemia among preschool Sudanese children, to evaluate the risk factors associated with anemia, and to correlate the relationship between hemoglobin concentration and food groups.

Methods: A sample of 300 Sudanese children 3-5 years of age from Wad Medani Greater Locality, Gezira State were included in this study, during period from July 2014 to February 2015. Cyanmethemoglobin method was used to measure hemoglobin concentration. Dietary data and food habits of children were collected using pre-tested questionnaires.

Results: The study showed that, the highest haemoglobin concentration was 12.04±0.08g/dl, and the lowest haemoglobin concentration was 7.9±0.79 g/dl. The overall prevalence of anaemia in the study population was 58.4% and 13.3% were moderately anaemic with haemoglobin level (7- 9.9) g/dl.

Conclusion: This study indicated high prevalence of anaemia among preschoolSudanese children. It was identified that, some factors such as child's age, father's education level, working mothers, income, residence and consumption of fruits, vegetables and meat have positive correlation on hemoglobin concentration level.

Key words: Anemia, children, food, hemoglobin

INTRODUCTION

Nutritional anemia is defined as anemia which occurs when there is a deficiency of one or more of the essential nutrients required for the synthesis of hemoglobin and the production of erythrocytes. Several nutrients are required for erythropoiesis, iron, folic acid, Vitamin B_{12}, protein, pyridoxine, and Vitamin C, copper and possibly Vitamin E are all necessary for the proper function of the bone marrow.[1]

Anemia is a major child health problem worldwide. The most common reason for anemia in infants and children is the inadequate supply of iron in the diet. Iron is a mineral the body needs to make red blood cells. Children go through periods of rapid growth and the diet should supply enough iron to facilitate the increased need for more red blood cells.[2] The World Health Organization has suggested that the level of hemoglobin (Hb) <11 g/dl in children aged 1–2 years and <11.2 g/dl in children aged 3–5 years was used to determine anemia prevalence.[3] In the most areas of the world, iron deficiency affects primary infant and young children, due to their higher iron requirements related

to growth. The effect of anemia includes retardation of physical and mental development, fatigue, and low productivity at work and low school performance.

METHODS

In this cross-section community-based study, a sample of 300 children was involved from Wad Medani Locality, Gezira State, during the period from July 2014 to February 2015. Signed informed consent was obtained from children parents or guardian. Children who were not suffering from malaria during the past 3 months, no history of blood loss or anemia, and not suffering from chronic diseases were involved in the study and those children who were sick or whose parent or guardians did not give signed informed consent were excluded in the study. Hemoglobin is oxidized by potassium ferricyanide into methemoglobin which is converted into cyanmethemoglobin by potassium cyanide. The intensity of the color formed is proportional to the hemoglobin concentration in the sample.[4] Dietary data were collected using pre-tested questionnaires. The blood samples were taken from

Table 1: The mean and SD of Hb level among the subject according to their sex, age group, and residence

Variable	Mean±SD (Hb g/dl)
Sex	
Males	10.65±0.72
Females	10.21±0.70
Age groups (years)	Mean±SD (Hb g/dl)
3 years	10.06±0.72
4 years	10.91±0.76
5 years	11.68±0.66
Residence	Mean±SD (Hb g/dl)
Rural	10.51±0.76
Urban	10.70±0.65

SD: Standard deviation, Hb: Hemoglobin

Table 2: The mean and SD of Hb level among the subject according to education level of their fathers, mother's job, and income

Variables	Mean±SD (Hb g/li)
Fathers education level	
Primary school	10.39±0.68
High school	10.52±0.71
Graduate	10.74±0.40
Postgraduate	11.33±0.40
Mothers occupation	Mean±SD (Hb g/li)
Housewife	10.60±0.72
Working	11.19±0.07
Family income	Mean±SD (Hb g/dl)
High income	11.31±0.69
Medium income	11.60±0.70
Low income	10.17±0.49

SD: Standard deviation, Hb: Hemoglobin

finger prick and the prevalence of anemia was determined based on the number of children with hemoglobin concentrations <11.0 g/dl according to the cutoff point recommended by the WHO.[5]

RESULTS

In this study, the highest Hb concentration was 12.04 ± 0.08 g/dl, while the lowest Hb concentration was 7.9 ± 0.79g/dl. The overall prevalence of anemia in the study population was 58.4% with Hb level <11 g/dl while 13.3% were moderately anemic with Hb level 7–9.9 g/dl.

Table 1 shows the mean and standard deviation (SD) of Hb concentration compared with the sex, age, and residence. The female children under the study have a mean hemoglobin value lower than that of males. Children did not show a significant difference in their mean hemoglobin level according to sex (P = 0.0081). The mean of Hb value for the children of the first group (3 years) was 10.06 ± 0.717 g/dl, for the second group (4 years) was 10.91 ± 0.755 g/dl, and the third group (5 years) was 11.68 ± 0.657 g/dl. The probability of correlation between Hb and age groups was P = 0.032, the difference was significant.

Children showed a significant difference in their mean of Hb concentration according to residence. Children from urban area in this age group had greater mean Hb concentration than those from rural area (P = 0.037).

Table 2 shows the mean and SD of Hb concentration among children according to their fathers education level, mother occupation, and income. It was found that the mean Hb was 11.33 ± 0.404 g/dl for those whose father was postgraduate, while 10.39 ± 0.675 g/dl for those whose their father had primary education. The difference was significant (P = 0.00).

It was found that the mean Hb concentration for those whose their mothers were housewives was 10.60 ± 0.716 g/dl and 11.19 ± 0.0675/dl for those whose their mothers were working. The difference was significant (P = 0.00).

The mean of Hb concentration of those children whose family income is higher was greater than those with medium and low income. The probability of correlation is P = 0.014. The differences were significant.

Table 3 shows the mean and SD of hemoglobin concentration level among the subject according to food groups. Regarding vegetable intake, there was positive correlation between Hb concentration and vegetables intake with the property of correlation (P = 0.00).

Concerning fruits intake, the mean Hb concentration is greater in the group who consumed more than four units (minimum requirement) and lowest with children who consumed <4 units and the difference was significant (P = 0.00). With regard to meat consumption, the mean Hb concentration was higher with the children who consumed more than three units of meat (minimum requirement) and lowest with those who consumed <3 units. Meat intake had positive effect on Hb concentration (P = 0.00).

Concerning milk consumption, the mean Hb concentration is greater with the group of children who consume more than two units and lowest with children who consume <2 units, the relationship was not statistically significant (P = 0.110).

It was found that bread and cereal consumption had no positive effect on mean hemoglobin concentration (P = 0.218).

DISCUSSION

This study showed that anemia considers as major health problem among children in Wad Medani Great locality, Sudan. 58.4% of 3–5-year-old children suffer from anemia with Hb level <11 g/dl while 13.3% were moderately anemic with Hb level 7–9.9 g/dl. These results indicated low anemia case than that reported by Soares and Clements[6] in Sub-Saharan Africa who stated that 76.1% of preschool children were anemic with Hb level <11 g/dl and 11% severe anemic with Hb ≤7 g/dl. DM, Hussien, and Mohamed[7] reported that 80.4% of the preschool children in Karma Albalad area, Northern Sudan, were anemic and higher than that reported by Alawadi[8] among preschool children in Kuwaiti who reported that 23.0% of children were anemic. 4.9% of the children, their hemoglobin concentration level between 7g/dl to 9.9 g/dl and none of them below 7 g/dl. Females children under this study had lower hemoglobin concentration level than males. This result does not agree with Kotecha[9] in India who reported that girls had higher mean Hb than boys. Tengco *et al.*[10] reported that females in rural Filipino had higher Hb than males. Our results showed that the 3 years children were the lowest Hb values. This finding was in agreement with Kotecha[9] in India who reported that increase age of children correlated with high Hb levels and also with Aizhao *et al.*[11] who reported that older

Table 3: The mean and SD of Hb level among the subject according to food groups

Variables	Mean±SD (Hb g/dl)
Vegetables intake	
>4 units	10.77±0.67
4 units	10.27±0.60
<4 unit	9.70±1.12
Fruits intake	Mean±SD (Hb g/dl)
>4 units	11.48±0.71
4 units	10.90±0.61
<4 units	10.39±0.67
Meat intake	Mean±SD (Hb g/dl)
>3 units	11.93±0.81
3 units	10.87±0.65
<3 units	10.33±0.60
Milk and milk product	Mean±SD (Hb g/dl)
>2 units	10.77±0.65
2 units	10.72±0.76
<2 units	10.45±0.65
Bread and cereals	Mean±SD (Hb g/dl)
>4 units	10.45±0.69
4 units	10.70±0.71
<4 units	10.77±0.75

SD: Standard deviation, Hb: Hemoglobin

children had Hb values greater than younger children, on the other hand, Nawal *et al.*[12] reported that the risk of having anemia was 1.8 times more in children aged 5 years than children of 4 years. This study showed that children from urban area had greater mean Hb concentration than those from rural area. This result is similar to that reported by, Luo *et al.*[13] who stated that anemia rate is between 20% and 80% among student in rural primary schools. Several studies have shown that living in rural areas increase risk of anemia also Monteiro *et al.*[14] in Brazil indicated high prevalence of anemia in rural areas.

The study showed that fathers education level, mother occupation, and income had positive correlation with Hb concentration level. This result is similar to that reported by Malkanthi *et al.*[15] in Sri Lanka who indicated that factors were significantly associated with anemia were fathers and mothers education and monthly household income. Alawadi[8] reported that income is an important factor for the occurrence of anemia. On the other hand, Monteiro *et al.*[14] reported that the anemia is inversely proportional to income and maternal schooling.

There was positive correlation between consumption vegetables, fruits, and meat. This finding is similar to that reported by Van Nhien *et al.*[16] who stated that hemoglobin levels were positively associated with Vitamin C intake and were higher in children who ate fruits and vegetables. A similar finding was reported by Choi *et al.*[17] among children in Korean urban areas that the prevalence of low hemoglobin level was higher in those children who consume no meat.

The results showed that there was no relationship between high intake of milk, bread, and hemoglobin concentration level. Similar finding was reported by Oliveira and Osório[18] who study the relationship between high intake of cow's milk and anemia in children, they indicated that the use of cow's milk in lieu of other food rich in bioavailable iron was shown to be risk factor of anemia. There was a significant association between consumption of n600 ml cow's milk and anemia in Asian children living in England.[19] Gibson[20] reported that high consumers of cereal and lower intakes of Vitamin C and meat may have diluted the impact of cereal iron on iron status.

CONCLUSION

The prevalence of anemia is high in this study area, more study need to be done. Furthermore, efforts should be exerted through primary health-care program to improve the nutritional status with special emphasis on anemia.

REFERENCES

1. Indian Council of Medical Research. National Nutrition Monitoring Bureau: Prevalence of Micronutrients Deficiencies: Technical Report No. 22. Hyderabad India: National Institute of Nutrition; 2003.
2. McLean E, Cogswell M, Egli I, Wojdyla D, de Benoist B. Worldwide prevalence of anaemia, WHO vitamin and mineral nutrition information system, 1993-2005. Public Health Nutr 2009;12:444-54.
3. McLean E, Egli I, Cogswell M, Benoist B, Wojdyla D. Worldwide Prevalence of Anemia in Preschool Age Children and Pregnant Women and Non-Pregnant Women of Reproductive Age. Switzerland: Sight and Life Press; 2007. p. 1-12.
4. Drabkins DL, Austin JH. Spectrophotometric constants for common haemoglobin derivatives in human, dog and rabbit blood. J Biol Chem 1932;98:719-33.
5. WHO. Haemoglobin Concentrationfor Diagnosis of Aniemia and Assessment of Seventy Vitamin and Mineral Nutrition Information System. Geneva: WHO; 2011.
6. Soares M, Clements AC. Spatial heterogeneity of haemoglobin concentration in preschool-age children in Sub-Saharan Africa. Bull World Health Organ 2011;89:459-68.
7. Hussien MD, Mohamed S. The prevalence of anemia in preschool children in Karma Albalad, Northern state, Sudan. East Mediterr Health J 2014;20:33-8.
8. Alawadi A. Nutritional status survey of preschool children live in Kuwait. East Mediterr Health J 2003;2:386-95.
9. Kotecha PV. Nutritional anemia in young children with focus on Asia and India. Indian J Community Med 2011;36:8-16.
10. Tengco LW, Rayco-Solon P, Solon JA, Sarol JN Jr., Solon FS. Determinants of anemia among preschool children in the Philippines. J Am Coll Nutr 2008;27:229-43.
11. Aizhao Y, Yin P, Jiayin L, Titi Y, Zhoayan L, Yanli LV, *et al.* Prevalence of anaemia and its risk factors among children 6-36 months in Burma. Am J Trop Med Hyg 2012;87:306-11.
12. Nawal M, Quaoud E, Al-Shami P, Prakash VK. Anemia and associated factors among Kuawaiti preschool children and their mothers. Alex J Med 2015;51:161-6.
13. Luo R, Kleiman-Weiner M, Rozelle S, Zhang L, Liu C, Sharbono B, *et al.* Anemia in rural China's elementary schools: Prevalence and correlates in shaanxi province's poor counties. Ecol Food Nutr 2010;49:357-72.
14. Monteiro CA, Mondini L, Souza AL, Popkin BM. The nutrition transition in Brazil. Eur J Clin Nutr 2005;49:326-30.
15. Malkanthi KD, Undith KJ, Yasinghe M. Risk factor associated with high prevalence of anemia among children under 5 years of age in puddy -family house hold in Srilanka. SAGE J 2010;31:10-14.
16. Van Nhien N, Khan NC, Ninh NX, Van Huan P, Hop le T, Lam NT, *et al.* Micronutrient deficiencies and anemia among preschool children in rural Vietnam. Asia Pac J Clin Nutr 2008;17:48-55.
17. Choi HJ, Lee HJ, Jang HB, Park JY, Kang JH, Park KH, *et al.* Effects of maternal education on diet, anemia, and iron deficiency in Korean school-aged children. BMC Public Health 2011;11:870.

18. Oliveira MA, Osório MM. Cow's milk consumption and iron deficiency anemia in children. J Pediatr (Rio J) 2005;81:361-7.
19. Lawson MS, Thomas M, Hadiman A. Iron status of school children. J Pediatr 2008;342:13.
20. Gibson A. Iron intake and iron status of preschool children association of breakfast cereal Vitamin C and meat. Public Health Nutr J 2014;2014:521-8.