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Frequency of Nutritional Megaloblastic Anemia among Students in Khartoum, Sudan

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ABSTRACT

Background: Megaloblastic anemia is a generative macrocytic anemia characterized by nuclear dysmaturity and the nucleus immature appearance in comparison to the cytoplasm due to a defect in DNA synthesis anemia is a rare ailment in children that is usually caused by a vitamin deficiency or gastrointestinal disorder

Objectives: The main objective of this study was to detect the frequency of nutritional megaloblastic anemia in male elementary-school children by measuring hemoglobin (Hb), red blood cell (RBC) count, hematocrit (HCT), and serum folate levels.

Methods: This study examined 300 male primary-school children in Khartoum, Sudan. A 2.5-ml of blood was drawn from each student and placed in an ethylene diamine tetra acetic acid (EDTA) vial to estimate the Hb level, RBC count, and HCT using an automated blood analyzer. Another 2.5 mL of blood were drawn from the same students into a plain container and examined for serum folate.

Results: The mean Hb was 12.7 g/dl (two standard deviations), the RBC count was 4.71012 cells/L, and the mean packed cell volume (PCV) was 37.2%, and the mean serum folate was 4.4 ng/L.

Conclusion: The blood parameters and serum folate were found to be within normal ranges. According to the findings, the nutritional status of the primary-school students was good, and megaloblastic anemia was not common. This type of research should be done on a frequent basis to assess children's nutritional health.

1. INTRODUCTION

Anemia is a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet physiologic needs[1]. Approximately 3.6% of people with anemia have megaloblastic anemia (MA)[2]. Folate deficiency (FD) is common in many parts of the world, especially in low and middle-income countries. It has become increasingly rare in countries where certain food groups have been supplemented with folate, and folate fortification of food in developed countries has decreased the prevalence of FD to <1% of the population[3]. In countries where the food supplementation is not practiced, FD is more frequent. Over the last three decades, the prevalence of FD seems to have decreased from 70–75% to 2–10% according to various studies on children from different regions. However, the prevalence of FD varies among different communities with different eating habits and socioeconomic levels**.**

Nutritional anemia is a common public-health issue that is linked to a higher risk of morbidity and mortality, particularly in pregnant women and young children[4]. Vitamin B12 and folic acid are required as co-factors for nucleoprotein synthesis, are deficiencies of these vitamins are the most common causes of megaloblastic anemia in children[1,2]. Nutritional megaloblastic anemia develops between the ages of 3 and 18 months in children who are exclusively breastfed, which mainly results from the mothers' insufficient nutrition and low levels of vitamin B12 and folate in the breast milk[5]. The average age of onset is 60 years, and it is uncommon in children except in impoverished nations, where it is more common due to socioeconomic conditions and a lack of vitamin B12 in food[6].

Megaloblastic anemia is caused by a lack of DNA synthesis, which prevents nuclear division. There is no effect on cytoplasmic maturation is mostly reliant on RNA and protein production. This causes asynchronous maturation between the nucleus and cytoplasm of erythroblasts, which explains the megaloblasts' greater size[7]. Some of the other alterations are low hemoglobin and erythrocyte counts, increased mean corpuscular volume (MCV > 100 fl), increased mean corpuscular hemoglobin concentration (MCHC), thrombocytopenia, and a low reticulocyte count[8].

Low levels of vitamin B12 (VN = 191–663 pg/ml) or folic acid (VN = 4.6–18.7 ng/ml) in the blood confirm the diagnosis. Biochemical evaluation of megaloblastic anemia patients reveals elevated levels of lactate dehydrogenase (LDH), total bilirubin, and primarily indirect bilirubin (IBIL), which is common in individuals with significant mean corpuscular volume (MCV)[9]. All these signs point to megaloblastic anemia patients having a high rate of erythrocyte destruction. Some researchers believe that erythrocytes can be killed in the bone marrow before they mature and are discharged into the peripheral circulation.

2. MATERIALS AND METHODS

The nutritional condition of children was assessed using complete blood count (CBC) and serum levels of folic acid over a 4-month period. 300 children were examined. The age range was 6 to 14 years. They were recruited from 12 primary schools that were chosen based on their geographic and socioeconomic diversity. These included seven schools for males and five schools females. Each school provided between 25 and 30 blood samples.

The study was done with the cooperation of school officials and students' families. All participants were told about the study's goals and the importance of health in the future. A total of 2.5 ml of blood was obtained in ethylene diamine tetra acetic acid (EDTA) tubes for CBC analysis, and another 2.5 ml of blood was collected for serum folate.

A 2.5-mL sample of venous blood was collected and gently mixed in an EDTA container before being labeled with the student's number. A Sysmex automated blood analyzer was used to evaluate the blood samples for CBC within 4 hours. The other 2.5-mL sample of blood was drawn and placed in a simple container to clot, after which the serum was separated using a bench centrifuge machine at 2500 rpm for 10 minutes. An automated device was used to determine the amount of folate in the blood (TOSOH CORPORATION, AIA 600ii).

An immunoenzymetric (IEMA) or sandwich immunoassay, competitive binding (EIA) immunoassay, and two-step immunoenzymetric immunoassay can all be performed with the AIA-600 II. A two-step immunoenzymetric immunoassay and a competitive binding (ELISA) immunoassay were done using an immunoreaction test cup from the AIA-PACK reagent series after combining a patient sample, control, or calibrator with a diluent to start an antigen-antibody reaction. During the incubation time of the IEMA assay, antibodies bind to two different epitopes on the antigen being evaluated, forming a sandwich. During the incubation period of the EIA assay, antigen from the patient sample competes for a limited number of antibody-binding sites with enzyme-labeled antigen.

3. RESULTS

This study involved 300 male primary-school students. The mean hemoglobin (Hb), packed cell volume (PCV), MCV, mean corpuscular hemoglobin (MCH), MCHC, and red blood cell (RBC) count were 12.0 g/dl, 35.6%, 83.0fl, 27.0 pg, 32.3 g/dl, 32.2%, and 4.71012 cells/L, respectively (Table 1). The average serum concentration of folic acid was 6 ng/ml.

Table 1. Demographic characteristics

Gender, n (%)	**Total n=200**	**Age, years (mean ± standard deviation)**	
Male	120	9.3±4.6	
Female	80		

Table 2. Mean blood parameters

Blood parameter	**Mean**
Hb level (g/dl)	12.0
PCV (%)	35.6
RBCs count (10 4.7 6 /µl)	4.7
MCV (fl)	83.0
MCH (g/dl)	27.0
MCHC (pg)	32.5
TLC (10^3/µl)	7.0
Platelets Count ((10^3/µl)	320
Folic acid (ng/ml)	6

4. DISCUSSION

In general, megaloblastic anemia is a type of macrocytic anemia caused by a lack of vitamin B12 or folic acid[9]. Hematologic anomalies are linked to megaloblastic anemia. Hematologic signs of megaloblastic anemia include leukopenia, thrombocytopenia, pancytopenia, and macrocytosis[4,6]. In this investigation, we examined the connection between megaloblastic anemia and hematological state. The range and incidence of hematologic abnormalities in children with megaloblastic anemia are not well documented statistically[4,6,11,12]. Hematologic abnormalities including anemia have often been associated with megaloblastic anemia, while pancytopenia, leucopenia, and thrombocytopenia are less common[4,6].

Patients with megaloblastic anemia are still common in outpatient facilities in Sudan, and there are a few interesting facts to consider[10]. Folate is a carbon donor for the synthesis of pyrimidine and purine, which is required for the rapid development of erythroid cells. FD causes erythroid cell death and anemia due to impaired DNA synthesis[11]. Because there are few publications showing folate deficiency in school-aged children, one of the most afflicted groups, this study could help to provide information on the degree of the deficiency of folic acid.

Hb, PCV, RBC, MCV, MCH, MCHC, total leucocyte count (TLC), platelet count, and folic acid were all found to be within normal limits. Megaloblastic anemia is a rarely diagnosed anemia in children, although it is likely underdiagnosed. It has multiple causes, including autoimmune disease, poor socioeconomic conditions, protein-calorie malnutrition, vegetarian nutrition of the mother during pregnancy with a lack of substitution during pregnancy and breastfeeding, and maternal megaloblastic anemia[12].

Due to variances in study populations comprising adolescents and young people, there are no differences in folate values between the findings of this study and those of other investigations. These figures are also influenced by dietary status, and genetic factors such as polymorphisms fluctuate between countries and geographical areas. Folate supplementation, in addition to iron and folic acid substitution, should be supplied to all mothers during pregnancy and lactation, especially if the mother is vegetarian or has a low socioeconomic background[13]. In conclusion, folate insufficiency is not frequent among schoolchildren according to this research. This study showed that blood tests and serum folate levels are useful indications in the diagnosis of nutritional anemia.

STATEMENT ON DATA SHARING

The corresponding author will provide the datasets used or analyzed in the current study upon reasonable request.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The Department of Medical Laboratory Sciences at the Sudan University of Sciences and Technology in Khartoum, Sudan, granted ethical clearance. Before the commencement of data collection, informed, voluntary, written, and signed consent forms were obtained from each participant's. In order to protect the privacy and confidentiality of the respondents' information, their names were not written on the questionnaire. Informed consent was obtained on behalf of participants under the age of 18 years. Participants were told that the study was voluntary, that they may refuse to participate at any time, that they could ask any questions they wanted to, and that their answers would not be used against them. The Helsinki Declaration was followed in the conduct of this investigation.

REFERENCES

1) Kaur N, Nair V, Sharma S, Dudeja P, Puri P. A descriptive study of clinico-hematological profile of megaloblastic anemia in a tertiary care hospital. *Med J Armed Forces India* 2018; **74**(4): 365-370. doi:10.1016/j.mjafi.2017.11.005
2) Petry N, Nizamov F, Woodruff BA, Ishmakova R, Komilov J, Wegmüller R, et al. Risk Factors for Anemia and Micronutrient Deficiencies among Women of Reproductive Age-The Impact of the Wheat Flour Fortification Program in Uzbekistan. *Nutrients* 2020; **12**(3): 714. doi: 10.3390/nu12030714. PMID: 32156021; PMCID: PMC7146397.
3) Al Rakaf MS, Kurdi AM, Ammari AN, Al Hashem AM, Shoukri MM, Garne E, et al. Patterns of folic acid use in pregnant Saudi women and prevalence of neural tube defects Results from a nested case-control study. *Prev Med Rep* 2015; **2**: 572–6
4) Haidar J, Melaku U, Pobocik RS. Folate deficiency in women of reproductive age in nine administrative regions of Ethiopia: an emerging public health problem. *South Afr J Clin Nutr* 2010; **23**(3): 132–7
5) Hasswane N, Bouziane A, Mrabet M, et al. Prevalence and factors associated with anemia pregnancy in a group of Moroccan pregnant women. *J Biosci Med* 2015; **3**(10): 88–97
6) Abdullahi H, Gasim GI, Saeed A, Imam AM, Adam I. Antenatal iron and folic acid supplementation use by pregnant women in Khartoum, Sudan. *BMC Res Notes* 2014; **7**(1): 498. doi: 10.1186/1756-0500-7-498
7) Ghaderi N, Ahmadpour M, Saniee N, Karimi F, Ghaderi C, Mirzaei H. Effect of education based on the Health Belief Model (HBM) on anemia preventive behaviors among Iranian girl students. *Int J Pediatr* 2017; **5**(6): 5043–5052.

8) Rahman MM, Abe SK, Rahman MS, et al. Maternal anemia and risk of adverse birth and health outcomes in low-and middle-income countries: systematic review and meta-analysis. *Am J Clin Nutr* 2016; **103**(2): 495–504. doi: 10.3945/ajcn.115.107896 .
9) Siddiqui B, Rabindranath D, Faridi SH, Khan AA, Haiyat S, Eswaran R. Megaloblastic anemia: A common but often neglected cause of pyrexia of unknown origin. *J Transl Int Med* 2015 Apr-Jun; **3**(2): 64–67. PMID: 27847889
10) Maynard AG, Pohl NK, Mueller AP, Petrova B, et al. Folate depletion induces erythroid differentiation through perturbation of de novo purine synthesis. *Sci Adv* 2024 Feb 2; **10**(5): eadj9479. doi: 10.1126/sciadv.adj9479
11) Rodrigues V, Dias A, Brito MJ, Galvão I, Ferreira GC. severe megaloblastic anaemia in an infant. *BMJ Case Rep* 2011; **2011**: bcr0220113835. doi: 10.1136/bcr.02.2011.3835
12) Ridwan N, Shafi A. Adherence to iron folate supplementation and associated factors among pregnant women attending antenatal care at public hospitals in Jigjiga Town, Somali Region. *Ethiopia* 2020. *Pan Afr Med J* 2021; **40**: 196. doi: 10.11604/pamj.2021.40.196.27958