Prevalence & etiology of nutritional anaemia among school children of urban slums

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Background & objectives: The prevalence of anaemia has been well studied particularly on etiology of nutritional anaemia in children of age group 5-10.9 yr in India. The present study was carried out to find out the prevalence and etiology of nutritional anaemia among 5 to 10.9 yr old corporation school children from urban slums.

Methods: Urban Delhi slums were divided into four areas and one corporation school from each area was randomly selected. A total of 406 children from 4 each school were randomly selected over a period of one yr and prevalence of anaemia was estimated. Another subset of 95 anaemic children admitted to the hospital during the same period were evaluated for the etiology of nutritional anaemia.

Results: Prevalence of anaemia as judged by WHO recommended cut-off values of haemoglobin among these children was 41.8 per cent. Pure or mixed iron deficiency anaemia was the commonest type of anaemia noted in 68.42 per cent (65 of 95) children followed by pure or mixed B12 deficiency noticed in 28.42 per cent (27 of 95) anaemic children. Of the pure variety, iron deficiency was the commonest cause occurring in 41.05 per cent (39 of 95) children.

Interpretation & conclusion: Childhood anaemia continues to be a significant public health problem in school children aged 5 to 10.9 yr and iron deficiency either alone or in combination is the commonest nutritional cause of anaemia. Pure or mixed vitamin B12 deficiency is an important but yet not commonly recognized cause of anaemia among these children.

Key words Anaemia - childhood - iron deficiency - prevalence - vitamin B12

Nutritional anaemia is a recognized public health problem throughout the world. An estimated 30 per cent of the world’s population is anaemic, with the global prevalence of anaemia among 6-12 yr old children to be 36 per cent1,2 and 77 per cent in developing regions respectively3,4. In earlier studies prevalence of anaemia among 5-14 yr old urban and rural Indian children was found to be in the range of 66.7 to 77 per cent3,5. Recent studies on prevalence of anaemia have been on preschoolers only6,7. There is a paucity of data on etiology of nutritional anaemia among children with special reference to micronutrient deficiencies8,9. The present study was undertaken to determine the prevalence of anaemia among school children aged 5 to 10.9 yr from urban slums and an attempt is also made to define the etiology of nutritional anaemia among this vulnerable group of children.

Material & Methods

The study was conducted during May 1999 to April 2000 in the Department of Paediatrics, University College of Medical Sciences (UCMS) and Guru Teg Bahadur (GTB) Hospital, Delhi and in the schools of East Delhi.
The children were selected from the urban slums located near the GTB Hospital. The slums were divided into four areas (Nand Nagri, Dilshad Garden Jhuggi cluster, Seema Puri and Khera) and one school from each area was randomly selected after taking consent from the competent authority. A minimum of 100 children were randomly selected from each school. Children from Class I to V were included in the study after randomized selection using class roll numbers keeping in mind equitable distribution from 5-10.9 yr of age (20 children from each class). Informed consent was obtained from the parents. The protocol was approved by the ethics committee of the institution. A detailed history was taken and each child was clinically examined. A complete haemogram was obtained using automated haematology Coulter T 890 counter, USA. As per the WHO recommendations1,2, anaemia was diagnosed when Hb was <11 g/dl for children <6 yr and <12 g/dl for ≥6 to 14 yr old children. Anaemia was further graded as mild (Hb=9.0 - 10.9 g/dl for 5-5.9 yr old and Hb 9.0 - 11.9 g/dl for ≥6 yr old), moderate (Hb = 6.0 -8.9 g/dl) and severe (Hb<6.0 g/dl), same for both age groups of children10. The nutritional status of each child was assessed using Gomez classification of weight for age11. The reference standard for each criterion was taken as 50th centile of affluent Indian children12.

Another set of 95 anaemic children aged 5-10.9 yr residing in the same urban slums around the hospital and attending one of the corporation school was included to study the etiology of nutritional anaemia using detailed laboratory investigations. These children were admitted to the hospital twice a week on emergency days of our unit with complaints either of anaemia only or with associated acute illness. The children with acute illness were investigated only after the acute illness was over so that the results of the study are not affected. Care was also taken to exclude children suffering from chronic infections by detailed clinical examination.

The laboratory investigations included hemoglobin estimation by cyanmeth-hemoglobin method13. In all anaemia children iron studies (serum iron, total iron binding capacity and per cent transferrin saturation) were carried out by techniques recommended by the International Committee for Standardization in Hematology (ICSH)14,15. Children who were not found to be iron deficient, were subjected to bone marrow aspiration (using paediatric size Sahli’s needle) from the posterior superior iliac spine and bone marrow was stained by Wright’s stain13. Blood samples were drawn for serum vitamin B12 and folate estimation. The samples were stored at -20°C and estimations were carried out after collection of all the samples. Serum folic acid was estimated by the method of Kelly et al16, and serum vitamin B12 was estimated by the method of Astier and Baud17, using high performance liquid chromatography (HPLC) (Merck, Germany) equipped with binary pumps, ultraviolet detector, amperometric detector and rehodyne injector.

One ml serum separated by centrifugation, was deproteinised by the addition of 100 µl perchlorate (60% v/v). After vortexing, rapid freezing, thawing and centrifugation, the supernatant was removed. The supernatant was brought to pH 7.0 with 100 µl of 6 per cent KOH. It was dried using nitrogen evaporation followed by addition of 100 µl HPLC grade methanol. The test solution was vortexed. The HPLC column was eluted isocratically at 1 ml/min with citrate phosphate buffer (0.1 M, pH 4.0), acetic acid (1% v/v) and methanol; 20 µl of test solution was injected into the rehodyne injector. The peaks of folic acid and vitamin B12 were plotted between concentration vs area under the time curve. From this, the concentrations of folic acid and vitamin B12 in serum were calculated. The normal values ranged between 200-900 pg/ml for serum vitamin B12 and 3-20 ng/ml of serum folate18. The cut-off values of various parameters were: transferrin saturation < 16 per cent19,20, serum vitamin B12 < 200 pg/ml and serum folic acid <3 ng/ml18,21. Combined deficiency anaemia was interpreted when either two or all micronutrient deficiencies (iron, vitamin B12 and folic acid) existed together.

Statistical analysis: Mean and 95 per cent confidence interval in each group was calculated. Unpaired ‘t’ test was used to find out the statistical significance of Hb values between males and females and also between malnourished and normal children.

Results

Of the 406 children, 205 (50.5%) had normal nutrition, 145 (35.87%) had grade I malnutrition, 51 (12.6%) had grade II malnutrition and 5 (1.2%) had grade III malnutrition. The mean Hb value (11.95±1.08g/dl) of malnourished children (n=201) was not significantly different from that of normal children (n=205, 11.80±1.21g/dl).
Prevalence & etiology of anaemia: Of the 406 children, 170 (41.8%) 95% CI 37.07- 46.67 per cent were found to be anaemic. The mean haemoglobin levels among these children were 11.86 ± 1.16 g/dl (95% CI 11.75 - 11.97%). Among the 5-5.9 yr old children, mild anaemia was found in 28.9 per cent and moderate anaemia in 2.9 per cent children. Among ≥6 yr old children, mild anaemia was most commonly seen (143 of 337) in 42.4 per cent children (Table I). There was no significant difference in the mean haemoglobin values among 95 boys (11.90 ±1.02g/dl) and 311 girls (11.85 ±1.20g/dl) in the present study. Interestingly, history of worm infestation was elicited in 47.5 per cent school children studied.

Of the 95 children studied for etiology of anaemia, 51 were boys and 44 girls (Table II). Pure or mixed iron deficiency anaemia was found in 68.42 per cent children followed by pure or mixed vitamin B₁₂ deficiency in 28.42 per cent children. Pure iron deficiency was the commonest cause occurring in 41.05 per cent children (Table III). Vitamin B₁₂ deficiency (n=7) and folic acid deficiency (n=1) alone or in combination (n=2) was noticed in 10 children. Bone marrow examination could be carried out in 8 of these 10 children as parents of 2 children did not give consent. The bone marrow revealed megaloblastic changes in 6 children.

Discussion

The prevalence of anaemia in urban slum school children aged 5 to 10.9 yr was found to be 41.8 per cent in the present study. DeMaeyer et al² reported the prevalence of anaemia in 6-12 yr old children to be 36 per cent, while study³ among 5-15 yr old urban school children.
Iron deficiency anaemia was found to be the commonest followed by vitamin B\textsubscript{12} and folic acid deficiencies in the present study. Megaloblastic marrow was noticed in six of the eight children tested. The normoblastic marrow noticed in the two children could be due to recent nature of the deficiency as it takes 5 to as long as 24 months for megaloblastic reaction to occur\textsuperscript{24}. A similar study carried out among 90 preschool children (3 months to 3 yr age) to find out the etiology of nutritional anaemia also revealed the same findings\textsuperscript{8}. The notable feature of the present study was the presence of vitamin B\textsubscript{12} deficiency as the second most common cause of deficiency anaemia as shown earlier\textsuperscript{8}.

The higher prevalence of combined deficiency anaemia as noticed in the present study may be attributed to inadequate food intake, poor stores and other nutritional deficiencies among these children. In the present study, in 20 of 95 children the cause of anaemia could not be ascertained. Three of these children revealed megaloblastic changes in bone marrow aspiration though their serum vitamin B\textsubscript{12} and folate levels were normal. It could be due to haematinic intake. The reasons in other children for anaemia are not known.

To conclude, childhood anaemia continues to be a significant public health problem in school children and iron deficiency either alone or in combination is the commonest nutritional cause of anaemia. Pure or mixed vitamin B\textsubscript{12} deficiency is an important yet not commonly recognized cause of anaemia in school children aged 5-11 yr in the community.

References


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