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Is it inadequate diet or unbalanced diet, as an important etiological association of nutritional anaemia in children aged 1 to 5 Years?

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Abstract

Introduction: Nutritional anaemia in under 5 children is not decreasing despite profound efforts, so question arises is it single nutrient deficiency or wrong dietary pattern which is responsible for some manifested and other masked micronutrient deficiencies?
Materials and Method: 300 under-5 children who were apparently normal and came to the OPD of a tertiary level care hospital in urban Ghaziabad for routine vaccination or minor ailments of short duration were enrolled. Haemoglobin, S. Iron., Ferritin, MCV, MCHC, MCH were done in all. If these investigations were suggestive of iron deficiency anaemia than only S.B12 and folate levels were estimated. Anthropometric data (weight, height),and 24 hr. dietary recall was analysed to assess nutritional status and nutritional intake according to recommendations of ICMR both in terms of number of serves as well as amount per serve
Results: Nutritional anaemia was found in 78% children of which 88% were having iron deficiency anaemia while 12% had macrocytic anaemia due to Vitamin B12 deficiency. None had folate deficiency.73% children in anaemia group were having moderate (67.8%) and severe (5.5%) underweight. Regarding dietary pattern the daily intake was less than recommended for cereals, pulses, GYOR vegetables and fruits in 45%, 87% and 98% children respectively. While daily intake of milk (although quite diluted) and high trans-fats snacks was much higher and intake was frequent than the recommendations. Calorie gap was found in staggering 97.4% children while protein gap was present in only 4.7% children.
Conclusion: To combat the nutritional anaemia the approach should be directed towards overall improvement of dietary habits rather than isolated instructions to consume more of iron rich diet.

Keywords: Nutritional anaemia, Children under 5, Dietary pattern.

Introduction

Nutritional anaemia in young children is a topic that is being explored regularly and extensively for last few decades by various researchers from all over India, yet its prevalence has increased from 74% in NFHS-2[(1)] to 79% in NHFS-3.[(2)] This is quite surprising and alarming in view of undoubtedly huge efforts and extensive promotions of ongoing anaemia prophylaxis programme by government of India and at the same time better awareness and more willingness of parents today from all social strata, to spend on health related issues of their children.

Present research work was an attempt to know whether it is mainly the deficient intake of iron containing food items alone or rather the unbalanced composition of diet responsible for this high prevalence and increasing trend of nutritional anaemia in under 5 children. The main reason to choose this particular age group was rapid mental and physical growth being during this period, if is interfered with will lead to lifelong harmful consequences and also the prevalence of anaemia is highest among them.

Materials and Method

Present study was a cross sectional observational study in which children between 1 to 5 years of age attending paediatrics OPD of a tertiary level health care facility in urban Ghaziabad were enrolled between May 2015 to March 2016. These children were coming for routine vaccination or with minor physical illnesses of short duration. If a child was already on haematinics or had signs and symptoms of non-nutritional anaemia or was not willing for blood sample than he was excluded.

Anthropometric data collected were weight and height. Children were classified as malnourished (WHO 2006 criteria)[(3)] using weight for age (WFA) and height for age (HFA), if less than -2SD. 24 hr dietary recall was recorded to calculate the child's daily calorie and protein intake. Food pyramid for each child was made using the number of serves and amount per serve of different 5 food groups, (1-cereals, 2-pulses and fruits and vegetables, 3- milk and 4- non veg, 5- sugar and fat). Age specific NIN guidelines[(4)] were used to decide about the adequacy of amount and number of serves of food items per day.

The Haemoglobin levels used to define anaemia were according to age specific WHO guidelines.[(5)] Blood sample was collected to analyse values of Hb, MCV, MCHC, MCH, Serum iron, Serum ferritin. If above reports were suggestive of dimorphic or macrocytic anaemia, then B12 and folic acid levels were done.

Results

Population characteristics- Total 300 children met eligibility criteria during study period and majority were between 1 to 3 years of age. 94 (31.3%) children were from socio-economic strata IV while 187(62.3%) belonged to socio-economic strata III (Kuppuswamy 2012).[(5)]

Anaemia severity and type- Of these 300 children, 233 (78%) were found to be anaemic. 175 (58%) had moderate anaemia, while 50 (17%) had mild anaemia. Severe anaemia was present in 8 (3%) children. The mean level of Hb in anaemic and non-anaemic children is shown in table1 and the difference between mean of these two groups was significant. But the more relevant observation is that the values of mean haemoglobin of non-anaemic group was 11.72 +/- 0.37 gm %, not far away from cut off value of 11.5 gm % used to define anaemia.

Table 1: Comparison of mean Haemoglobin level in 2 study groups

Children	Haemoglobin Level		t - Test
	Mean	+/- SD	P Value
Normal	11.72	0.37	0.001
Anaemic	9.12	0.96	

Serum iron /ferritin/B12/Folate. Mean serum iron in anaemic group was 20.9 +/- 2.3 which is almost half of the value observed in non-anaemic children (39.02 +/- 8.1). The normal range of serum ferritin level is 10 to 60 ng /dl and mean S. Ferritin level of anaemic children was almost 1/4th of the value found in non-anaemic children (7.71 +/- 5.3 vs 30.83 +/- 6.1).

Serum B12 and folic acid levels as planned were done in 25 children only, who were having dimorphic/ macrocytic anaemia. Folic acid levels were normal in all 25 children of this sub group with mean value of 7.57 +/- 2.46 m mol/ml But B12 levels were low with mean value of 95.2+/- 5.48, almost half of the normal value as is evident from Table 2.

Table 2. Serum Levels of Micronutrients related to haemoglobin synthesis in study participants

Investigation	Normal Children		Anaemic Children		t - Test
	Mean	+/- SD	Mean	+/- SD	P Value
S. Ferritin (ng/ml)	30.8	6.18	7.71	5.35	<0.001
S. Iron (mcg/dl)	39.02	8.25	20.90	2.34	<0.001
S. Folate (m mol/ml)	--	--	7.57	2.46	--
S. Vitamin B12 (pg/ml)	--	--	95.28	5.48	--

Dietary analysis revealed that 227 (97.4%) out of 233 anaemic children were having calorie gap while protein gap was found in only 11 (4.7%) children, concluding that macronutrient deficient intake do exist with nutritional anaemia. Careful dietary analysis of 24 hr dietary recall reveal following facts:

- Less than recommended number of serves of cereal per day (< 6 to 11) in 45% anaemic children.
- Less than recommended number of serves and also the amount per serve of pulses per day in 87% anaemic children[(2)]
- Almost all (98%) children had no consumption or only 1 to 2 serves of fruits and vegetables of green, yellow, orange and red colour (GYOR) category of fruits and vegetables in contrast to recommendations (3 to 4 serves per day). Potato was the main or the only vegetable consumed universally by all children.
- In 40% of children, the number of serves and amount of milk intake per day was much higher at > 3 to 4 times per day when compared with recommendation of 2 times or 500 ml per day, but at the same time, although the milk was diluted from 25% to 50%, but the food pyramid was found to be inverted with wide top and narrow base.
- Consumption of snacks rich in transfat in the form of bhujiyas, namkeens, oyes and crax (a type of fried snack), chips, etc. was high, ranging from 1 to 4 packets per day.

Table 3: Dietary intake pattern of study participants

Food group	No of serves per day		Inadequate in anaemic children group (N=233) %
	Recommended	Actually Taken	
Cereals/rice	6-11	4 – 5	45
Pulses	2-3	0 – 1	87
GYOR fruits/vegetables	3-4	1 – 2	98
Milk/milk products	2	3 – 4	Excessive intake in 40%
Non veg/egg	1-2	0 – 1	88
Fat & Sugar	3-5tsp	>> recommended	Excessive intake in 44%

On the basis of **anthropometry**, 170 (73%) children out of 233 anaemic children were having weight for age (WFA) in moderate to severe underweight category (67.8% and 5.5 % respectively). While only 2 children in non-anaemic group were underweight.

Discussion

An individual do not eat isolated nutrients, instead they eat meals consisting of a variety of foods with complex combination of nutrients.[6] Dietary analysis in present research brought forward three main patterns –

Firstly under 5 children are getting lot of milk, with inverted food pyramid which has wide apex but narrow base. As the milk is being offered 4 to 5 times, it overlaps or coincides with lunch or dinner time, so children don't feel hungry. More over this milk was over diluted ranging from 25% to 33% in most of the families. So it was mostly forming the major bulk of the diet but with little calories.

Second important pattern was very low intake of pulses, fruits and vegetables of green, yellow, orange and red colour (GYOR) and so food pyramid was narrow in middle in majority of study subjects.

Third important pattern was intake of high fat containing snacks was very common particularly in children from nuclear families.[7] Fast food has high levels of trans-fat which provide only calorie but minimal to no micronutrients.[8]

Parent's usual reasons to give milk so many times per day were mainly that even while asleep he takes bottle full of milk or if he does not take anything else at least he is taking milk so they feel better. Normal value of serum iron is 22 -184 mg/dl and mean serum iron levels of non-anaemic children at the value of 39 mg/dl was situated at the lower side of this wide range, signifying their shift to iron deficiency status quickly when exposed to any adverse health situation. This is very important observation as it again highlights the fact that apparently healthy looking children too are near the lower limit of normal values.

For developing countries, researchers agree that poor quality rather than quantity of diets is the key determinant of impaired micronutrient status, including iron deficiency. It has been reported that food-based approaches are more sustainable, simultaneously addresses a combination of deficiency problems, although it is established that the major cause of anaemia in India is nutritional iron deficiency, it is indeed difficult to prioritize cause(s) when there are confounding factors such as multiple micronutrient deficiencies. Vitamin C status is often marginal, as major dietary sources are seasonal vegetables and fruits. Folate and vitamin B 12 are necessary for erythropoiesis and the synthesis of DNA. The intakes of green leafy vegetables, which are major sources of folate, and animal products, which are main source of vitamin B12, are meagre in India. Inadequacy in riboflavin intake also reduces absorption and utilization of iron. Vitamin B 6 is required for haemoglobin synthesis and therefore for erythropoiesis. Recent studies have indicated that here are other deficiencies that are currently widespread but not recognized. For example, dietary intake surveys show that intake of all the key micronutrients is low.[9,10]

So it is evident that although the parents are concerned about the health of their children but they need guidance regarding healthy age specific diets which is usually superficially and inadequately addressed during their visit to their paediatricians or physicians. So parental attitude has to be changed .Parents have to be role model to their children by refraining themselves from eating fast food, and also by eating all vegetables and fruits themselves.

Conclusion

High parental confidence on over diluted (so nutrient poor) milk rich diet and under inclusion of variety of fresh fruits and vegetables and under consumption of pulses along with excessive intake of fried snacks are some of the problematic and important focus area for prevention of not only nutritional deficiency anaemia but also other non-communicable diet related diseases.

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