ORIGINAL ARTICLE

Assessment of Nutritional Status of Anemic Children

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ABSTRACT

Background: Anemia resulting from severe iron deficiency is the most prevalent and widespread nutrition related health problem among infants/children because their rapid growth increase iron needs.
Aim: To assess the nutritional status of iron deficient anemic children aged 1-3 years and to figure out clinically observable nutritional risks present in them.
Study design: Hospital based cross-sectional study.
Setting: The Children's Hospital and Institute of Child Health (CHICH), Lahore
Duration of study: From 5th June to 15th July, 2011.
Sample: Fifty iron deficient anemic children aged 1-3 years were included in the study
Method: The sample was collected from general medical wards of the Children's Hospital & the Institute of Child Health, Lahore. Convenience sampling technique was used to reach the targeted sample size of 50 iron deficient anemic children. The children were screened for iron deficiency anemia on the basis of hemoglobin, hematocrit, RBC indices and serum iron levels.
Result: Results showed a high prevalence of IDA and poor nutritional status of children aged 12–18 months as majority of the wasted (63%), underweight (58%) and stunted children (54%) belonged to this age group. Clinical assessment of the children indicated the presence of multiple nutrient deficiencies. Breastfeeding was not continued till the recommended duration by the majority. Delayed weaning was associated with low weight-for-age. Majority had a low intake of calories and iron, and a high intake of protein. Vegetables were consumed the least except for starchy vegetables.
Conclusion: High susceptibility of children to iron deficiency due to their increased iron needs for rapid growth and relatively low iron content in the diets of majority of the children necessitates a need to plan effective dietary strategies that could help prevent IDA among children.
Keywords: IDA, Iron deficiency anemia

INTRODUCTION

Anemia refers to a decreased oxygen carrying capacity of the blood[1]. The anemias that result from an inadequate intake of nutrients particularly iron, protein, certain vitamins (B12, folic acid, pyridoxine, and ascorbic acid), copper and other heavy metals are called nutritional anemias[2]. .Iron deficiency anemia is a condition that occurs when the oxygen carrying capacity of the blood is decreased because there is insufficient iron to make hemoglobin [3].Iron deficiency is probably the most common nutritional deficiency disorder in the world. It is estimated to affect nearly 5000 million people worldwide. Overall globally, 39% of preschool children are anemic[4].In iron deficiency anemia, the percentage of total blood volume occupied by red blood cells (RBC's) called the hematocrit falls below 34-37%. The blood hemoglobin concentration also declines to less than 10-11g/100ml of blood[1].

Iron deficiency anemia is common in infants and children because their rapid growth increase iron needs. The recommended intake of iron for children aged 1 to 3 years is 7mg[3]. Iron deficiency anemia has widespread effects on children's behavior too. It lowers the motivation to persist intellectually challenging tasks, shortens the attention span and impairs overall intellectual performance[5].

Nutritional status is defined as a state of health as it is influenced by the intake and utilization of nutrients. Evaluating the nutritional status of populations and individuals can help in identifying their nutritional needs and be used to plan diets to meet these needs[3]. Several parameters to assess a person's nutritional status are anthropometry, biochemical and hematological parameters, clinical and physical assessment and dietary intake. Since childhood is a period of growth and development, energy requirement is greater. Children must have an adequate intake of protein too as it is needed for proper growth and maintenance as well as for the synthesis of globin fraction of hemoglobin. The most commonly used methods to assess iron status include serum ferritin, transferrin saturation, erytrocyteprotoporphyrin, mean corpuscle volume, serum transferrin receptor and hemoglobin or packed cell volume[4].

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RESEARCH METHODOLOGY

A cross-sectional survey was conducted to carry out this research. The purpose of conducting this study was to assess the nutritional status of iron deficient anemic children and to figure out clinically observable nutritional risks present in the children. Population of the study consisted of iron deficient anemic children of 1 to 3 years of age. The sample of the study consisted of 50 iron deficient anemic children of 1 to 3 years of age. The sample was selected irrespective of sex. The sample was collected from general medical wards of the Children's Hospital & the Institute of Child Health, Lahore from 5th June to 15th July, 2011. Convenience sampling technique was used to reach the targeted sample size of 50 iron deficient anemic children. Children were first screened on the basis of their hemoglobin. Only those children were selected who had less than 10g/dl of hemoglobin and were admitted in the hospital either with the diagnosis of anemia itself or some other acute ailment, not associated to cause anemia. These children were then screened for iron deficiency anemia on the basis of hematocrit, mean corpuscular hemoglobin, mean corpuscular volume, mean corpuscular hemoglobin concentration and serum iron levels. Only those children who were meeting the parameters of iron deficiency anemia were included in the study and others were excluded from the study.

Interview schedule was planned to collect relevant data. For this purpose, a questionnaire was developed which included general information about the patient and his/her family, medical history, basic anthropometric measurements, certain blood parameters, clinical examination, dietary history and food intake of the patient.

Clinical assessment: Clinical assessment of the sample involved physical examination of hair, eyes, teeth, gums, lips, tongue, nails, skin, face, muscles and posture. The purpose of this assessment was to observe the most prevalent clinical signs and symptoms of iron deficiency anemia or any other nutritional deficiency that might be present in the sample.

Dietary assessment: The following two methods were used to assess the food intake of the sample i.e. usual day intake and food frequency checklist.

Data analysis and interpretations: Data obtained from the survey was analyzed by using SPSS software 17 and Microsoft Office Excel 2007. Children's weight-for-age, length/height-for-age, weight-for-length/height and head circumference-for-age were calculated by using WHO child growth standards (percentiles). All the data obtained was entered into the grid sheets of SPSS software. While analyzing the data, objectives of the study and research questions were kept in mind.

Categories were made for those variables which had multiple values. Codes were given to each category. Data for most of the variables was analyzed on the bases of frequency distribution and percentage. Whereas, certain tests were also applied to some variables which mainly included chi-square test and one-sample t-test. A p-value lesser than $\alpha=0.05$ ($p<0.05$) was considered significant for all the tests. Many variables were simply cross-tabulated without the application of any statistical test. Mean value, maximum value, minimum value and standard deviation were the main parameters of statistical analysis of some variables. Results obtained from data analysis were presented in Microsoft Office Word 2007 in the form of tables and figures. The survey bore significant findings.

RESULT

Results showed that 26(52%) of the sample comprised of girls whereas the percentage of boys was slightly lower i.e., 24(48%). The prevalence of anemia was highest in the age group of 12-18 months i.e. 30(60%).

Figure 1 indicates that 11(22%) children showed low physical activity, 20(40%) were moderately active whereas 19(38%) children were highly active. Out of 50 children, 17(34%) children were consuming certain type of nutritional supplement whereas 33(66%) children were not given any nutritional supplement. Results show the presence of food allergy or food intolerance among 18(36%) children. Out of 50 children, pica was present among 31(62%) anemic children whereas no form of pica was present among the remaining 19(38%) children.

Results showed that 31(62%) children were below 3rd percentile of weight-for-age. 24 (48%) children were below 3rd percentile of length/height-for-age. Result shows that 30(60%) children were below 3rd percentile weight-for-length/height. It was evident that 20(40%) children were below 3rd percentile of head circumference-for-age. The mid-upper-arm circumference (MUAC) of 24 (48%) children was equal to or less than 12.4cm.

Table 1 shows that out of a total of 31 children who were below 3rd percentile of weight-for-age, 18(58%) children were of 12-18 months of age. Thirteen children (54%) who were below 3rd percentile of height/length-for-age were also belonging to the age group of 12-18 months. Nineteen (63%) and 11 (55%) children whose weight-for-height and head circumference-for-age was below 3rd percentile respectively belonged to the same age group of 12-18 months. Ten (63%) children who had chest circumference smaller than head circumference

and 16(67%) children whose mid-upper-arm circumference was equal to or less than 12.4cm belonged to 12-18 months of age.

Results showed that the level of hemoglobin (Hb) was 7.0±1.6, which was below the standard value (11-13gm/dl). The level of hematocrit (Hct) was 4.7±24.5 which was below the standard value (33-43%). The value of mean corpuscular volume (MCV) was 58.9±9.19 which was less than the standard value (80-100fl). The value of mean corpuscular hemoglobin (MCH) was 16.4±3.5 which was less than the standard value (25-33pg). The mean corpuscular hemoglobin concentration (MCHC) was 28.0±2.9 which was below the standard value (31-37%). The level of serum iron was 18.6±6.6 which was also below the standard value (50-120µg/dl) for children.

Results indicated the presence of depigmented hair among 24(48%) children .The presence of easily pluckable and sparse hair was noticeable among 29 (58%) and 30(60%) respectively. Forty-seven (94%) children had pale eyes. Fourty (80%) children were being breastfed. Out of those 40(80%) children, 20(50%) children had been breastfed for less than twelve months of age.

Figure 2 implies breast's milk to be the current milk intake of 2(4%) children at the time of study. Thirty-seven (74%) children were consuming cow's milk. Milk intake of 7(14%) children comprised of both the breast milk and cow's milk whereas 3(6%) children were not consuming any form of milk. Out of a total of 37 children who were currently consuming cow's milk, 7(19%) children were never breastfed, 20 (54%) were breastfed for a period less than 12 months of age, 6(16%) children were fed breast milk till 12 months of age whereas 4(11%) children received breast milk till an age more than 12 months. Data indicated that weaning foods were introduced to 31(62%) children at six months of age whereas 14(28%) children received weaning after six months of age .Data showed that delayed weaning was associated with low weight-for-age.

Table 2 shows the mean and standard deviation of children's daily intake of calories, protein and iron. One sample t-test was applied to compare children's intake of calories, protein and iron with the recommendation. For energy, the value of t(21)=-8.650,p=0.000 and t(20)=-8.493,p=0.000 of boys and girls aged 12-24 months respectively were significant at α=0.05. The value of t(1)=-18.06,p=0.035 of girls aged 25-35 months and t(2)=-5.0,p=0.038 of girls aged 36 months were significant also at α=0.05 whereas test could not be applied on boys aged 25-35 months and boys of 36 months because of insignificant number of children in both age groups.

For protein, the value of t(49)=2.31,p=0.025 of both girls and boys aged 12-36 months was significant at α=0.05 whereas for iron, the value of t(49)=-41.1,p=0.000 of both girls and boys aged 12-36 months was also significant at α=0.05. Results of one-sample t-test reflected that the average intake of calories and iron by all children of all ages was less than the recommendation whereas the average protein intake was high. Iron intake of all the children was less than the RDA.

Results showed that 39(78%) children did not consume deep yellow vegetables and 35 (70%) children did not consume dark green leafy vegetables, throughout the week. Data indicated that 10(20%) children consumed starchy vegetables twice a week whereas another 10(20%) consumed them thrice a week. Results corroborated no weekly consumption of fresh fruit juices and packaged fruit juices by 44 (88%) and 17 (34%) children, respectively. Data indicates that 38(76%) children did not eat citrus fruits throughout the week whereas other fruits were consumed twice a week by 8(16%) children and 8 (16%) children consumed those fruits six times a week. Results also confirmed the consumption of milk to be more than seven times a week by 43 (86%) children. Results showed that mutton and fish were not consumed by the children throughout the week. Only 2 (4%) children took beef twice a weak whereas 7 (14%) children consumed chicken thrice a week. Forty-three (86%) children did not eat liver throughout the week whereas 4 (8%) consumed it once a week. Seventeen (34%) children consumed eggs thrice a week. Study indicates that majority of the children (n=27 i.e.54%) consumed chapatti more than seven times a week Eleven (22%) children consumed rice thrice a week. Results revealed that tea was the most preferred beverage to all the other beverages. Twenty-one (42%) children consumed tea seven times a week. Majority of the children (n=37 i.e. 74%) ate biscuits seven times a week

Table 1: Incidence of Poor Anthropometric Measurements With Reference to Age

Age (Months)	Weight-for-Age (Below 3rd percentile)		Height/length-for-Age (Below 3rd percentile)		Weight-for-Height (Below 3rd percentile)		Head Cir-for-Age (Below 3rd percentile)		Chest Cir < Head Cir		MUAC (12.4cm or less)	
	F	%	f	%	f	%	f	%	F	%	F	%
12-18	18	58	13	54	19	63	11	55	10	63	16	67
18-24	8	26	7	29	8	27	5	25	5	31	7	29
24-30	2	6	1	4	1	3	2	10	1	6	1	4
30-36	3	10	3	13	2	7	2	10	0	0	0	0
Total	31	100	24	100	30	100	20	100	16	100	24	100

Table 2: Comparison of Children's Intake of Calories, Protein and Iron with the Recommendation

Nutrients	Gender	Age (Months)	n	Mean	SD	Standard value	t- value	p-value
Energy(Kcal)	Boys	12-24	22	718	177	1046	-8.650	0.000
	Girls	12-24	21	720	146	992	-8.493	0.000
	Boys	25-35	1	520		1394		
	Girls	25-35	2	641	53	1317	-18.06	0.035
	Boys	36	1	685		1742		
	Girls	36	3	858	273	1642	-5.0	0.038
Protein (gm)		12-36	50	14	3	13	2.31	0.025
Iron (mg)		12-36	50	2.64	0.75	7	-41.1	0.000

Fig. 1: Physical Activity Level of the Children

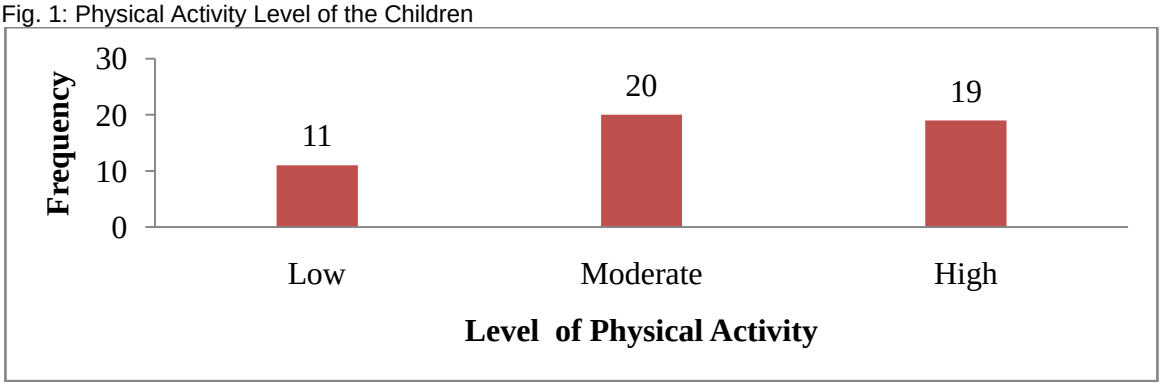
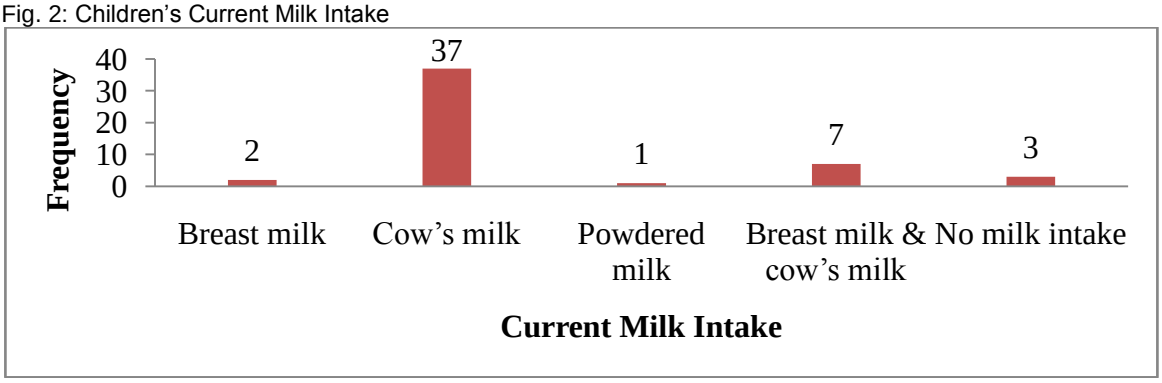


Fig. 2: Children's Current Milk Intake



DISCUSSION

The present study was conducted to assess the nutritional status of iron deficient anemic children of 1-3 years of age. The nutritional status of 50 iron deficient anemic children was assessed on the bases of four parameters of nutritional assessment i.e., anthropometric assessment, biochemical assessment, clinical assessment and dietary assessment. Results of the study showed that the prevalence of iron deficiency anemia was highest among children aged 12-18 months.

Out of a total of 50 children, 20(40%) children had normal physical activity whereas 11(22%) children showed an activity level that was below the standard of physical activity for toddlers set by National Association for Sport and Physical Education (NASPE) which recommends that toddlers must engage in a total of 30 minutes of structured physical activity and at least 60 minutes – and up to several hours – per day of unstructured physical activity and should not be sedentary for more than 60 minutes at a time, except when sleeping[7] (NASPE, 2009). Pica, a classic symptom of iron deficiency anemia, was prevalent among majority of the children.

Assessment of children's weight and length/height by using WHO child growth standards revealed that not a single child was above 97th percentile for any of the three anthropometric indices. The number of underweight children was the highest, the next highest was the number of children who were experiencing wasting whereas the number of stunted children was the lowest as compared to the other two indicators of poor nutritional status.

The incidence of poor nutritional status as evidenced by various anthropometric measures was highest among the age group of 12-18 months, next

was the age group of 18-24 months, the incidence was lower among children of 30-36 months whereas it was lowest among children aged 24-30 months.

WHO recommends exclusive breast feeding up to 6 months of age, with continued breastfeeding along with appropriate complementary foods up to two years of age or beyond. Result of the study showed that WHO recommendation regarding breast feeding was not being followed by majority of the children.

Results of the study regarding current milk intake by the children at the time of data collection showed that early introduction of cow's milk to the children could be a factor that led to iron deficiency anemia among some of the under study children. Woodhead's statement (2003)[8] that switching from breast milk or infant formula to unmodified cow's milk before age 12 months is one of the leading causes of iron deficiency supported this finding of the present study. Delayed weaning was associated with low weight-for-age.

According to the study results the daily caloric intake by both girls and boys was far below the estimated energy requirement (EER) for both genders. Iron intake of all the children (n=50) was below the daily requirement which is recommended by the National Academies of Sciences[9] (Whitney & Rolfes, 2005).

Food frequency checklist showed that vegetables were consumed the less except for starchy vegetables. Fresh fruit juices which are a good source of vitamins and minerals were not consumed by majority of the children (n=44 i.e., 88%) throughout the week. Citrus fruits, a good source of vitamin C that helps in the absorption of iron, were also not consumed by most of the children (n=38 i.e. 76%) throughout the week. Weekly consumption of other fruits mainly banana was greater than the consumption of citrus fruits.Children who were fed cow's milk were given milk in diluted form. The ratio of water to milk given to majority of the children was 2:1. Among certain other milk products, ice-cream and yogurt were highly consumed milk products.

Consumption of chicken was more as compared to mutton, beef and organ meat throughout the week which may be due to low-purchasing power of the under study children's families. Most of the children (n=17 i.e. 34) consumed egg twice a week. From cereal group, chapatti was consumed most frequently. Tea was the most frequently consumed beverage. Biscuits were the most frequently consumed food item of all the other food items mentioned in miscellaneous group.

Regarding the limitations of study, researcher's study was a single center study conducted on a limited number of iron deficient anemic children of specific age group. This single center study was just to estimate the magnitude of problem. The basic idea behind the study was to provided baseline information about the health status of iron deficient anemic children and to highlight some of the poor feeding/dietary practices that could have played a role in causing anemia among the under study children. To see the actual picture of reality, a wide spread study on national level in different hospitals of Pakistan is requiredso that necessary strategy can be sorted out for planning a nutrition education program for such children in later years.

CONCLUSION AND RECOMMENDATION

Iron deficiency is one of the most common nutritional deficiencies in the world. The prevalence of iron deficiency anemia was highest among children aged 12-18 months. Breast feeding practices was not being followed by majority of the under studied children according to WHO recommendations. Early introduction of cow's milk to the children and delayed weaning could be the factors that led to iron deficiency anemia among some of the under studied children. On an average, most of the under studied children had poor nutritional status and iron intake of all the children (n=50) was below the daily requirement. High susceptibility of children to iron deficiency due to their increased iron needs for rapid growth and relatively low iron content in the diets of majority of the children necessitates a need to plan effective dietary strategies that could help prevent IDA among children.

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