Original Article

Nutritional Status of Hospitalized Children with Nutritional Anaemia: A Cross Sectional Study

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ABSTRACT

Objective: To assess the nutritional status of hospitalized children diagnosed to have nutritional anaemia in Pakistan.

Study Design: Analytical study.

Place and Duration: From June 2009 and June 2010 at the Children Hospital, Islamabad.

Materials and Methods: The current study was undertaken Admitted nutritional anaemic children were enrolled and anthropometric measurement (height and weight) and haemoglobin levels were assessed. WHO standards were used to classify nutritional status and anaemia. SPSS version 20 software was used for data entry and analysis. Comparison between low haemoglobin levels (≤5 g/dl) and nutritional status was performed by using Student t and Chi-square tests. Levels of significant was considered at 5% (p=0.05).

Results: A total of 116 children with nutritional anaemia were enrolled. The mean (±SD) age was 2.5 (± 2.9) years and 68 (58.6%) were male. The mean (±SD) haemoglobin value was 4.44 (± 1.56) g/dl. Seventy one (61.2%), 63 (54.3%) and 55 (47.4%) children were classified as stunted, underweight and wasted respectively. The mean scores of HAZ, WAZ and WHZ were significantly lower in children who had haemoglobin level of ≤5 gm/dl compared to those who had >5 gm/dl haemoglobin level at the time of admission.

Conclusion: Children admitted with nutritional anaemia have very poor nutritional status. Majority of children are less than 2 years of age, presenting with nutritional anaemia and poor nutritional status in our study.

Key words: Nutritional status, Child, Anaemia, Hospitalized.

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Introduction

Anaemia, a condition in which the haemoglobin of the blood is lower than normal, is a priority nutritional problem in most of the developing countries because of the economic, social and other negative consequences of this condition.[1, 2] Anaemia is due to deficiency of one or more essential nutrients, severe blood loss, parasitic infections, acute and chronic infections, and congenital haemolytic diseases.[3] Deficiency of one or more essential nutrients like iron, vitamin-B12, or folic acid leads to nutritional anaemia, although in most areas of the world, anaemia is synonymous with iron deficiency.[4] Nutritional anaemia claims one million lives each year.[5] It is established that anaemia increases risk for maternal as well as child mortality and has negative consequences on the cognitive and physical development of children, and on work productivity in adults.[3] The United Nations had set up a global development goals in 2002 to be achieved in the early years of this new millennium to decrease nutritional anaemia. Despite this, the global incidence has hardly changed in the last decade. The reason for lack of improvement include multifactor aetiology of anaemia, under funding, and poor programme implementation.[5] Malnutrition continues to be a major public health problem in developing countries, especially in Southern Asia and Sub-Saharan Africa.[6] Research has revealed that diets in these populations are frequently deficient in macronutrients like protein, carbohydrates and fat, leading to protein–energy malnutrition, micronutrients such as electrolytes, minerals and vitamins, leading to specific micronutrient deficiencies or of both.[7]. Moreover, presence of high prevalence of bacterial and parasitic illnesses contributes greatly to malnutrition.[8].

Correspondingly, evidence has shown that malnourished person is more susceptible to severe infection and therefore malnutrition is a key component of morbidity and mortality from disease.[9]. As a result, malnutrition is the most important risk factor for the burden of disease in developing countries. Every year malnutrition causes approximately 300,000 deaths and is a major component of more than half of under 5 deaths.[9] Like other developing countries, malnutrition is also a major public health problem in Pakistan. Half of Pakistani children aged 5 years or less are stunted, more than one third are underweight and a quarter of all births are low birth weight.[10]

The current study was undertaken to assess the nutritional status of hospitalized children diagnosed to have nutritional anaemia in Pakistan.

Materials and Methods

It was hospital based study and included children aged between 6 months and 12 years with nutritional anaemia admitted to the Children Hospital, Pakistan Institute of Medical Sciences [PIMS], Islamabad, Pakistan. The enrolment was carried out between June 2009 and June 2010. Children admitted with anaemia with other reasons were excluded e.g., children with haematological liver, renal, gastrointestinal, neurological, oncological diseases, surgical pathologies were excluded.

At admission, informed verbal consent to participate in the current study was obtained from a parent or caretaker of each selected child. Information regarding their age, gender and clinical conditions was collected through an interview with parent or guardian. Capillary blood was collected from each child for the estimation of haemoglobin.

The anthropometric measurements were collected by the trained nurses within 48 hours of hospitalization and periodically validated by the researchers. Children less than 2 years of age were weighed with minimum clothing on a digital baby scale, with a 16 kg capacity and a sensitivity of 10 grams and their lengths were measured in decubitus dorsal on a flat surface with an anthropometric rule scaled in centimetres up to a maximum of 1 millimetre. Children aged more than 2 years were weighed with a minimum of clothing on an adult scale accurate to 100 grams. Height was measured with children standing upright against a vertical rule with a metric scale, reading up to 150 centimetres, marked off in centimetres and fixed to the wall.

The haemoglobin concentration cut-offs to define anaemia are the WHO–recommended cut-offs for each population group given in Table 1.[11]

The nutritional status of the enrolled children was assessed by means of z-scores for weight/age, stature/age and weight/stature, taking as reference standard the percentile curves published by the NCHS (National Centre for Health Statistics). Nutritional status was classified in accordance with WHO criteria as stunting (< -2 SD of height-for-age), wasting (< -2 SD of weight-for-height) and underweight < -2 SD of weight-for-age).[12]

Table I: Haemoglobin and haematocrit levels below which anaemia is present

Age group	Haemoglobin	Haematocrit	
	g/l	mmol/l	l/l
Children 6 months to 59 months	110	6.83	0.33
Children 5-11 years	115	7.13	0.34
Children 12-14 years	120	7.45	0.36

Statistical analysis: Using WHO standard formula for single proportion, and assuming 50% prevalence of nutritional anaemia in children admitted to hospital with anaemia, absolute precision as 9% and with 95% confidence level, the sample size for descriptive analysis was calculated to be 116. Data were entered and analysed using Epi Info 6.04 and SPSS version 20. For comparison purposes all the children were categorized into two groups based on their level of haemoglobin as up to 5 g/dl haemoglobin level and more than 5 g/dl haemoglobin. The Chi-square test was used for categorical variables and the Student t test was used for continuous variables. For all analyses the level of significance was set at $p < 0.05$.

Results

A total of 116 children admitted with nutritional anaemia were enrolled during the study period. The baseline characteristics and the nutritional status are shown in Table II.

Out of 116 children, 68 (58.6%) were male. The mean (±SD) age was 2.5 (±2.9) years and 66% children were less than 2 year of age. The most common complaint was progressive pallor (92.2%) followed by history of fever (40.5%). The mean (±SD) haemoglobin value was 4.44 (±1.56) g/dl. The mean (±SD) values of MCV, MCH and MCHC were 73.9 (±17.2), 21.7 (±10.0) and 28.9 (±8.2) respectively. The mean (±SD) scores of height doe age (HAZ), weight for age (WAZ) and weight for height (WHZ) z scores were -1.77 (±1.38), -1.66 (±1.37) and -1.15 (±1.74), respectively. Out of 116, 71 (61.2%), 63 (54.3%) and 55 (47.4%) children were classified as stunted, underweight and wasted respectively (Figure 1).

Table II: Baseline characteristics of all children (n = 116)

Characteristics	Number (%)
Age (in years)	6 month to 12 years
Mean (± SD)	2.57 (± 2.95)
Median (IQR)	1.25 (0.9 - 3.4)
Age categories	
Less than 1 year	32 (27.6%)
1-5 years	68 (58.6%)

More than 5 years	16 (13.8%)
Gender	
Male	68 (58.6%)
Female	48 (41.4%)
History of present illness	
Progressive pallor	107 (92.2%)
Fever	47 (40.5%)
Vomiting	19 (16.4%)
Failure to thrive	10 (8.6%)
Blood cells	
White blood cells	
Mean (± SD)	10736.21 (± 6766.42)
Median (IQR)	9600 (5075 - 13700)
Red blood cells	
Mean (± SD)	2.34 (± 1.34)
Median (IQR)	1.34 (1.46 - 3.00)
Haemoglobin	
Mean (± SD)	4.44 (± 1.56)
Median (IQR)	4.40 (3.4 - 5.6)
MCV	
Mean (± SD)	73.9 (± 17.2)
Median (IQR)	68.7 (58.4 - 93.0)
MCH	
Mean (± SD)	21.7 (± 10.0)
Median (IQR)	21.0 (13.3 - 29.8)
MCHC	
Mean (± SD)	28.9 (± 8.2)
Median (IQR)	28.9 (22.8 - 31.3)
Nutritional status	
Height-for-age z score	
Mean (± SD)	-1.77 (± 1.38)
Median (IQR)	-2.10 (-2.27 - -1.28)
Weight-for-age z score	
Mean (± SD)	-1.66 (± 1.37)
Median (IQR)	-2.15 (-2.42 - 0.00)
Weight-for-height z score	
Mean (± SD)	-1.15 (± 1.74)
Median (IQR)	-1.71 (-2.48 - -0.00)

SD: standard deviation. %: percentage. IQR: Interquartile range. MCV: mean corpuscular volume. MCH: Mean corpuscular haemoglobin. MCHC: Mean corpuscular haemoglobin concentration.

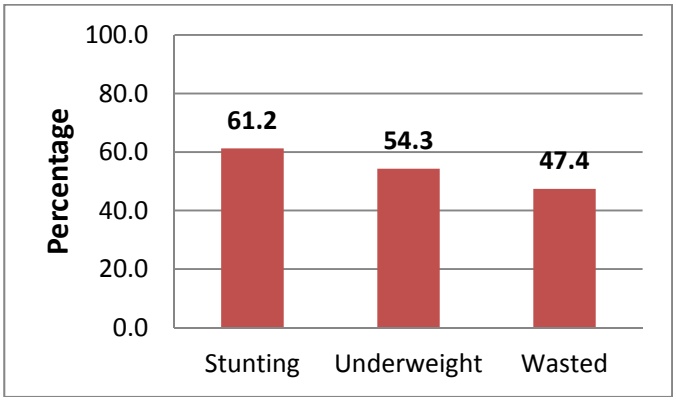

Figure 1: Nutritional status classification according to WHO criteria of all children (n = 116)

Out of 116 children, 70 (60.3%) children had haemoglobin more than 5 g/dl at the time of admission. The mean scores of HAZ, WAZ and WHZ were significantly lower in children who had haemoglobin level up to 5 g/dl than those who had more than 5 d/dl haemoglobin (Table III). Amongst those who had haemoglobin level up to 5 g/dl, 52 (74.3%), 50 (71.4%) and 39 (55.7%) were stunted, underweight and wasted respectively, while among those with more than 5 g/dl haemoglobin, 19 (41.3%), 13 (28.3%) and 16 (34.8%) were stunted, underweight and wasted respectively and these differences were statistically significant (p=values 0.0001, 0.0001 and 0.027 respectively).

Table III: Comparison of haemoglobin level with nutritional status of all children (n=116)

	Mean (±SD)		
Haemoglobin levels	**HAZ**	**WAZ**	**WHZ**
5 and less (n = 70)	-2.26 (± 1.13)	-2.06 (± 1.32)	-1.54 (± 1.54)
More than 5 (n = 46)	-1.01 (± 1.37)	-1.09 (± 1.21)	-0.54 (± 1.80)
p-value	0.0001	0.0001	0.002

SD: Standard deviation.
HAZ: height for age z-score. WAZ: weight for age z-score. WHZ: weight for height z-score

Discussion

Malnutrition in children is one of the major public health problems in developing countries and the most prevalent malnutrition problem is anaemia. Research has shown that the anaemia most frequently encountered in children is iron deficiency anaemia.[5] The current study found that about half of the children admitted with nutritional anaemia had poor nutrition status in terms of stunting, wasting and underweight. Further we found that children with haemoglobin levels ≤5 g/dl at the time of admission had significantly higher risk of being either stunting, wasting or underweight compared to those children with haemoglobin levels >5 g/dl.

Our study findings are comparable with other studies. A study from our neighbouring country India reported statistically significant associations of mild and moderate undernutrition with anaemia in preschool children. They found that children with moderate undernutrition had stronger association with anaemia than with mild undernutrition.[4] This indirectly reveals that unhealthy diet, i.e., deficient in adequate calories and micronutrients, is the cause of both of these conditions. The basic reason for it is poverty and illiteracy regarding healthy diet.

Our study showed that two third of the children had very low haemoglobin levels (≤ 5 g/dl) and presented with cardiac failure at the time of admission. We found that

children with low haemoglobin levels had significantly poor nutritional status than the children with relatively high haemoglobin levels. The consequences are devastating on the heart as well as long term debilitating effect on growth and cognition of these children. There is simple remedy to the situation that low haemoglobin levels should be picked up early at routine visits for vaccination or at outpatient clinics before the situation goes to cardiac failure and severe undernutrition.

Nutritional anaemia of all grades was quite prevalent in children less than 2 years of age in our study. One of the reason could be that the usual diet during the infancy is mainly based on milk and therefore, the iron requirements are not covered. Concurrently, children fed on cows' milk have more severe problem due to poor absorption of iron.[13]. Infants who are fed cows' milk starting in early infancy and those who are fed milk that is not iron fortified are at the highest risk for the development of iron deficiency. The situation becomes critical when iron stores at birth are reduced because of maternal anaemia. In older children, because of their slower growth rate and their more varied diet, nutritional anaemia is less prevalent as also shown in our study. Hence, in order to prevent nutritional anaemia there is a need to educate parents regarding weaning food, along with continuous breastfeeding, which contain all the essential requirements, especially iron contents. One of the important forum is during the antenatal care visit and other is during the time of vaccination. Furthermore, there is a need of action at government level in supplementing mothers and children through various community based programmes. There is a need to carry out hospital as well as community based nutritional rehabilitation programmes to overcome this problem. At the same time, in majority of paediatric hospitals in Pakistan, the routine management of nutritional anaemia includes blood transfusion and discharge on iron supplementations with no or very little nutritional advice to parents. Therefore, the current management should be reviewed and nutritional education and rehabilitation programmes should be included.

The strengths of the current study are, we collected data from a big tertiary care hospital in this region, and the weighing scales and height measuring boards were checked and calibrated by the researchers on fortnightly basis. However, the current study has some limitations too: as this is a cross sectional study therefore, it is difficult to determine the temporal sequence between nutritional anaemia and nutritional status, and data on dietary habits, which is an important component of the current research topic, were not collected.

Assessment of nutritional status is of fundamental importance to detect whether a child is growing within recommended limits or is falling outside of them due to disease or unfavourable living conditions. Measuring a child's growth is one of the most efficient ways of assessing their general state of health, making effective interventions possible that can re-establish ideal conditions for health and avoid the damage resulting from malnutrition.[14] Therefore, it is important to educate all the health care providers to measure child's height and weight during their routine visits either for vaccination or for minor illnesses and also whenever he/she is admitted with disease and plot his/her height and weight against standard charts.

Conclusion

Children admitted with nutritional anaemia have very poor nutritional status. Majority of children are less than 2 years of age, presenting with nutritional anaemia and poor nutritional status. It is pertinent to carry on hospital and community based nutritional programmes to overcome this persistent and growing problem in Pakistan.

References

1. Jamil KM, Rahman AS, Bardhan PK, et al. Micronutrients and anemia. *J Health Popul Nutr* 2008; 26: 340 - 55.
2. Baig-Ansari N, Badruddin SH, Karmaliani R, et al. Anemia prevalence and risk factors in pregnant women in an urban area of Pakistan. *Food Nutr Bull* 2008; 29: 132 - 9.
3. de Benoist B, McLean E, Egli I, Cogswell E. Worldwide prevalence of anaemia 1993–2005 : WHO global database on anaemia. Geneva: World Health Organization, 2008.
4. George KA, Kumar NS, Lal JJ, Sreedevi R. Anemia and nutritional status of pre-school children in Kerala. *Indian J Pediatr* 2000; 67(8): 575 - 8.
5. Kraemer K, Zimmermann MB, Sight TF. Nutritional anemia: Sight and Life Press Basel; 2007.
6. WHO, United Nations Children's Fund. Joint statement on the management of acute diarrhoea. Geneva: World Health Organization,, 2004.
7. Millward DJ, Jackson AA. Protein/energy ratios of current diets in developed and developing countries compared with a safe protein/energy ratio: implications for recommended protein and amino acid intakes *Public Health Nutr* 2004; 7: 387 - 405.
8. Stoltzfus RJ, Chway HM, Montresor A, et al. Low dose daily iron supplementation improves iron status and appetite but not anemia, whereas quarterly antihelminthic treatment improves growth, appetite and anemia in Zanzibari preschool children. *J Nutr* 2004; 134: 348 - 56.
9. Black R. Micronutrient deficiency - an underlying cause for morbidity and mortality. *Bull World Health Organ* 2003; 81: 79.
10. Bhutta ZA. Why has so little changed in maternal and child health in south Asia? *BMJ* 2000; 30: 809 - 12.
11. WHO. Iron deficiency anaemia: assessment, prevention, and control. A guide for programme managers. Geneva: World Health Organization, 2001.
12. World Health Organization. Nutrition Landscape Information System (NLIS) Country Profile indicators. Geneva, Switzerland: World Health Organization, 2010.
13. Oliveira MA, Osorio MM. [Cow's milk consumption and iron deficiency anemia in children]. *J Pediatr (Rio J)* 2005; 81(5): 361-7.
14. Rocha GA, Rocha EJM, Martins CV. The effects of hospitalization on the nutritional status of children. *Jornal de Pediatria* 2006; 82: 70 - 4.