ORIGINAL ARTICLE

BIOCHEMICAL PROFILE OF CHILDREN WITH ACUTE SEVERE MALNUTRITION AT A TERTIARY CARE SETTING

Muhammad Hussain[1], Muhammad Irshad[1], Mohsin Hayat[1], Humera Adeeb[2], Ihsan Ullah[5]

[1]Department of Pediatrics, MTI, Lady Reading Hospital, Peshawar - Pakistan

[2]Department of Community Medicine, Khyber Medical College, Peshawar - Pakistan

[5]Department of Pathology IBMS, Khyber Medical University, Peshawar - Pakistan

ABSTRACT

Objective: The objective of this study was to explore the frequency of biochemical factors in children presenting with severe acute malnutrition.

Materials and methods: Children having an age range of 6-59 months with severe acute malnutrition of more than six weeks' duration, admitted at Pediatric Unit, Leady Reading Hospital Peshawar were included in the study. The study was conducted for 6 months (October 13, 2018, to April 13, 2019). The child's age, weight, mother's gestational age, mode of delivery, birth weight, maternal education, and parity were recorded on a proforma. Blood samples were sent to the hospital laboratory for serum electrolytes, hemoglobin, serum calcium, serum albumin, random blood sugar and the frequencies of these biochemical profile were calculated. Data were analyzed in SPSS-20.

Results: Out of 161 children, 48% were 1-3 years old, followed by 33% 3-5 years old. The majority of children were females (62%). Low birth weight children were 60%. Maternal illiteracy was 58%. Multiparty of mothers was reported in 59% and 67% of children were born by spontaneous vaginal delivery. Anemia was the most common (98%) finding followed by hypokalemia (68%), hypocalcemia (35%), Hypochloremia (16%), and Hyponatremia (14%). Serum albumin was low in 7% of children. Hypoglycemia was found in 15% of children.

Conclusion: Anemia followed by hypokalemia was the commonest biochemical findings in acute severe malnutrition. Similarly, hypocalcemia and hypoglycemia were also common life-threatening conditions found in these patients.

Keywords: Malnutrition; Severe acute malnutrition

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INTRODUCTION

The global population is expected to reach nine billion by 2050. Ensuring good quality food availability and food security is a global concern.[1, 2] Malnutrition is prevalent globally but especially in underdeveloped countries. Asia has around 70% of the world's malnourished children. [3] The situation is grave in four southeast Asian countries- Pakistan, Nepal, Bangladesh, and India. Though, some indices of nutritional assessment have improved from 1996-2011 in Pakistan, still there is much room for improvement. This particular improvement was noted for improvement in parental education, household income, and being born in a medical facility. [3, 4] According to WHO, malnutrition is responsible for 60% of deaths in children under 5 years of age. [2] For children younger than 5 years, severe stunting and wasting are responsible for 2.2 million deaths and resulted in 21% disability-adjusted life years (DALYs) in children under five years of age[3].

Correspondence
Dr. Mohsin Hayat
Assistant Professor
Department of Pediatrics, MTI, Lady Reading Hospital, Peshawar - Pakistan
Email: mohsin_hayatsafi@yahoo.com
Cell: +92-334-9077238
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Children with severe acute malnutrition (SAM) is a life-threatening condition and is responsible for 35% of mortality in children under 5 years of age. [5, 6] SAM results from a bout of severe acute illness, inappropriate child feeding, and acute severe shortage of food. [7] These children are nine times more likely to die than children without malnutrition. [8] Children with SAM have low immunity and are susceptible to infections with poor recovery. At the individual level, SAM is significantly associated with fever, vomiting, diarrhea, and being stunted. [7, 9] Infections further exacerbate malnutrition and a vicious cycle sets in. [9] Malnutrition has long-term effects on psychological development and cognition. [10, 11] At the domestic level, SAM is significantly associated with the handwashing habits of child's caregiver, malnourished parents, lack of toilets at home, and lack of diversity in family meals. Large family size and suboptimal feeding practices and food insecurity at domestic level practices also contribute as deter-

minants of malnutrition in children. [12, 13] Bottle feeding, prelacteal feeds, lack of exclusive breastfeeding and short duration of exclusive breastfeeding have been identified as significant contributors to malnutrition in children. [14]

In Pakistan, a national nutrition survey in 2011 reported under 5 years' children as wasted (13%), underweight (15%) and stunted (44%). [5] The 2018 national nutrition of Pakistan, reported stunting as 40.2%, with an increase in underweight children to 28.9% and rise in wasted under 5 years' children to 17.7%. [15]

Clinical signs alone are poor indicators of infection in SAM. The initial clinical diagnosis correlates poorly with diagnosis confirmed by radiologic, biochemical, and culture studies. The presence of SAM undervalues clinical signs. The biochemical, biologic, and radiologic parameters are of substantial value in SAM to support the diagnosis. This study was designed to explore the frequency of biochemical factors in children presenting with SAM.

MATERIAL AND METHODS

This descriptive cross-sectional study was conducted at the Department of Pediatrics, Lady Reading Hospital Peshawar from 13th October 2018 to 13th April 2019. A sample of 161 children was taken based on 7% proportion of malnutrition according to WHO sample size formula. A child was diagnosed with severe acute malnutrition (SAM) when the child weight for age Z score was < -3 using child growth standards as published by the World Health Organization (WHO) in 2006. [16]

Sampling was done by non-probability purposive sampling. Children with the age range of 6 to 59 months and SAM of more than six weeks were included in the study. Prematurely born children, with congenital anomalies, surgical problems, and systemic diseases were excluded from the study. On the day of admission, histories were taken and children were weighed. Infants were weighed on baby scales and children from 1 to 5 years were weighed on flat scales. The child's age, weight, gestational age, mode of delivery, birth weight, maternal education, parity was recorded on a proforma. Blood samples were analyzed in the hospital laboratory for serum electrolytes, hemoglobin, serum calcium, serum albumin, random blood sugar, and test results were analyzed.

Data were analyzed in SPSS-20. SAM was stratified among age, gender, birth weight, mother's parity, mode of delivery, mother education status, mother residence (rural or urban) to see the effect of this on the biochemical profile of malnourished children.

RESULTS

Out of 161 children, 48% of children were in the age range of 1-3 years, followed by 33% in the age range of 3-5 years. The majority of children with SAM were females (62%). The majority of children (60%) had low birth weight as shown in table 1.

Maternal illiteracy was common among mothers of children with SAM (58%). Multiparty of mothers was reported in 59% and 67% children with SAM were born by spontaneous vaginal delivery as shown in table 2.

Anemia was the most common (98%) finding in children with SAM. Among electrolyte abnormalities, hypokalemia was most common (68%) in children, followed by hypocalcemia (35%), Hypochloremia (16%), and Hyponatremia (14%). Serum albumin was low in 7% of children. Hypoglycemia was found in 15% of children as shown in table 3.

Table 1: Age, gender, and birth weight of the study population (n=161)

1	Age	Frequency	Percentage
	<1 year	31	19%
	≥1-3 years	77	48%
	>3-5 years	53	33%
	Total	161	100%
2	Birth weight		
	≤2.5 Kg	97	60%
	>2.5 Kg	64	40%
	Total	161	100%
3	Gender		
	Male	61	38%
	Female	100	62%
	Total	161	100%

Table 2: Maternal education, parity, gestational age, and mode of delivery of study population

1	Maternal education	Frequency	Percentage
	Illiterate	93	58%
	Primary	39	24%
	Secondary	29	18%
	Total	161	100%
2	Mode of delivery		
	Spontaneous vaginal delivery	108	67%
	Cesarean section	53	33%
	Total	161	100%
3	Maternal parity		
	Primipara	50	31%
	Multipara	111	59%
	Total	161	100%

Table 3: Biochemical profile of children with severe acute malnutrition

s/ no	Biochemical profile	Frequency	Percentage
1	Hyponatremia	23	14%
2	Hypokalemia	109	68%
3	Hypochloremia	26	16%
4	Hypoalbuminemia	11	7%
5	Hypoglycemia	24	15%
6	Hypocalcemia	56	35%
7	Anemia	158	98%

DISCUSSION

Worldwide, 165 million children below five years of age are malnourished, and this increases the likelihood of mortality in these children secondary to acute infections. At times, an acute infection sets grounds for acute malnutrition and sets a vicious circle of repeated infections.

Severe acute malnutrition may present with the signs and symptoms of the cause of SAM or any feature of deficiency resulting from SAM. Iron deficiency anemia in SAM is the most common finding as anemia is common in children under 5 years even without features of SAM. A study from India reported anemia in 81.1% as compared to 98% in this study, out of whom 25% required blood transfusion. Iron deficiency was most common followed by macrocytic anemia. [17] Anemia was reported as 53.7%, according to the 2018 national health survey of Pakistan[15]. Anemia was reported 19.5% in children admitted with SAM and acute infection in Niger. [9] A similar trend was observed in a study conducted by Thakur N et al. in which children with SAM are more prone to develop iron deficiency. [18]

The present study showed Hyponatremia in 14% of children which was more than a study conducted in India showing only 3%. [19] The reason could be that their sample size was very small. Some studies also reported a higher 28.6% of Hyponatremia as compared to present study. [9] Similarly, Hypokalemia was reported in a higher proportion (68%) in the present study as compared to 32.4% in a study from Niger. [9]

Hypoalbuminemia was reported in 7% in our study (2.0 ± 0.8 g/dl) while the Indian study showed 21% which was a higher proportion. [19] Hypoglycemia was reported in 15% (83 ± 28 mg/dl- mean ± SD) of children in our study which showed acute malnutrition in these children. Similarly, important micronutrient calcium was also deficient in these children which possibly lead to bone weakness. Hypocalcemia was seen in 35% which was more than the Indian study which was 15%. [19] These findings warrant special attention to assessment and management of the acute electrolytes and hypoglycemia management in children with SAM.

One of the limitations of this study is single-center data which may compromise the generalization of findings. Further multicenter studies of this kind are needed to find the true prevalence of biochemical abnormalities in SAM babies.

CONCLUSION

Acute severe malnutrition is a life-threatening condition. Anemia followed by hypokalemia was the commonest biochemical findings in acute severe malnutrition. Similarly, hypocalcemia and hypoglycemia were also common. Deficiency of all these micronutrients can lead to long-term complications and growth retardation. The condition needs aggressive nutritional replacement supplementation to prevent the long-term complication of nutrition deficiency.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under

Hussain M:	Concept/ Idea, Literature review, Drafting & Final Review
Irshad M:	Literature review, Drafting & Final Review
Hayat M:	Concept/ Idea, Data collection, Literature review, Drafting & Final Review
Adeeb H:	Data collection, Literature review
	Drafting & Final Review
Ullah I:	Data collection, Literature review
	Drafting & Final Review

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.