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**ORIGINAL ARTICLE**

# Biochemical Profile of Malnutrition Children at a Tertiary Care Hospital

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## ABSTRACT

**Background:** Children's malnutrition is a major public health problem around the world. More than 41% of the deaths of children between the ages of six and 24 months in underdeveloped nations each year are attributable to it, which amounts to 2.3 million deaths. In our study, we'll examine the biochemical markers and nutritional indicators of these children when they first arrive.
**Aim:** To determine the biochemical profile of children with SAM presenting to Lady Reading Hospital, Peshawar.
**Methods:** A descriptive cross-sectional study was conducted in the Department of Pediatrics at Lady Reading Hospital in Peshawar, Pakistan. Pakistan is the home of the hospital. A total of 161 patients were assessed during this inquiry. Everyone's age, gender, gestation, delivery type (including cesarean section), and weight at birth have been recorded and accounted for. At the time of each child's admittance, their biochemical state (including their serum electrolytes, serum albumin, and hemoglobin level), as well as their age, gender, and weight for their age, were all taken into consideration. In the biochemical profile, low sodium (135mmol/l), low potassium (3.5mmol/l), low cholesterol (95), low albumin (35g/l), low calcium (2.2mmol/l), and low sugar (3mmol/l) were present, along with anemia (hemoglobin levels of 13 g/dl for males and 12g/dl for women). The mother's age, level of education, and location in the world were documented.
**Results**: In this study mean age was 3 years with SD±2.71. Thirty eight children were male and 62% children were female. Biochemical profile of 161 children with severe acute malnutrition was analyzed as hyponatremia was 23(14%) hypokalemia was 109(68%), hypochloremia was 26(16%), hypoalbuminemia was 11(7%), hypocalcemia was 56(35%), hypoglycemia was 24(15%) and anemia was 158(98%).
**Conclusion**: Our study concludes that the frequency of biochemical profile of children were hyponatremia was 14%, hypokalemia was 68%, hypochloremia was 16%, hypoalbuminemia was 7%, hypocalcemia was 35, hypoglycemia was 15% and anemia was 98% with SAM presenting to Lady Reading Hospital, Peshawar.
**Key words:** biochemical profile, children, severe acute malnutrition

## INTRODUCTION

Childhood malnutrition is one of the greatest threats to public health around the world. More than 41% of all children aged six to twenty-four months who die each year in low-income countries are thought to have died from this cause. Around 2.3 million people have died as a result of this. Many children under the age of five are suffering from malnourishment around the world. These diseases, which include pneumonia, diarrhea, malaria, the human immunodeficiency virus (HIV), sometimes known as AIDS, and measles, can place children at an elevated risk of death. Children died as a result of malnutrition 54% of the time in the year 2001, according to World Health Organization (WHO) figures. Malnutrition has impaired the growth of 39.5% of Pakistani youngsters (underweight)[1,2]. There are several and diverse reasons why people do not receive enough nourishment. Several factors, including socio-demographic, environmental, reproductive, institutional, cultural, and political factors, all play a role in causing undernutrition in children[3]. The most common symptoms of malnutrition are weight loss, an increase in thirst, and a fever[4].

A low blood sugar level, a low body temperature, an excess of fluid in the body, incorrect electrolyte management, and yet undetected diseases are all possibilities for children who are malnourished. They must be treated differently than other children. The micronutrients in their food, drink, and surrounding environment must be closely monitored and maintained in order to avoid problems with their care. 5 It's critical to know how these kids are doing in terms of their biochemistry and nutrition because of this. So that mistakes don't happen and the right amount of micronutrients are administered, they train us on how to care for children with SAM in hospitals and in especially in nutrition rehabilitation centers (NRC). All SAM youngsters admitted between 2013 and 2015 were included in the study. In addition to a comprehensive blood picture, the children were also given liver function tests, kidney function tests, serum electrolyte levels, calcium, phosphorus, and alkaline phosphatase assays as part of their biochemical and nutritional evaluations. 15% of the children had low blood sugar, 22% of the children had low potassium, 35% of the children had low calcium, 98% of the children had anemia, 7% of the children had low albumin, 14% of the children had low sodium, and 19% of the children had high sodium in their systems. The bulk of patients' blood loss was caused by microcytic hypochromic anemia (55%)[6].

According to another study, a whopping 6.8% of participants had low blood sugar, 9.5% of participants had low potassium levels, 10.12% of participants had low calcium levels, and 20% of individuals had low albumin levels[7].

SAM patients are more likely to have micronutrient deficiencies, such as iron, folic acid, and vitamin B12 deficiency. A protein deficiency, which can take several forms in the blood, is also more common in these people. A normocytic blood image was identified in 27.7% of patients, a microcytic hypochromic blood picture in 38.6% of cases, a megaloblastic anemia in 30.5% of cases, and a dimorphic blood picture in 3.2% of cases. We observed similar results in our own research[8].

There are many different viewpoints on the biochemical profile that have been expressed in prior research publications, therefore it's worth looking into them. The same biological components are examined in each paper, but in a different way. In light of this development, more study into this matter is possible. The biochemical markers of these children, as well as the nutritional indicators, will be examined as soon as they are brought in for our study. As a result of our actions, these youngsters could receive better care. Malnourished children's biochemical profiles need to be thoroughly understood so that we may better help these children based on the knowledge we've obtained about them in their home communities. To help those in need, the information gleaned from this study will be valuable.

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## MATERIALS AND METHODS

SAM was diagnosed by a pediatric expert with at least three years of experience after the CPSP approved the summary and all of the children who had been diagnosed with SAM and who met other inclusion criteria did so. When asked if they were okay with the data acquired from their children being used for future studies, the participants' parents said yes. Everyone's age, gender, gestation, delivery type (including cesarean section), and weight at birth have been recorded and accounted for. In addition to the child's age, gender, and weight in relation to their height, their biochemical status (such as serum electrolytes, serum albumin, and hemoglobin levels) were all taken into account at the time of their admission. Following abnormalities were found: hyponatremia (less than 135mg/L), hypokalemia (less than 3mg/L), hypocholaemic hypoalbuminemia (less than 35mg/L), hypocalcemia (less than 2.2mg/dL), and anemia (less than 13 mg for males and less than 3 mg for women) in the biochemical profile. The mother's age, level of education, and location in the world were documented. Upon admission, the patient's dietary habits were meticulously recorded in detail. SPSS version 23 was used to analyze the data that had been collected. For continuous variables such as age, gestational age, and birth weight, this study calculated the mean and SD. Gender, mother's parity, delivery type (natural vaginal birth or cesarean section), hyponatremia, hypokalemia, hypochloremia, hypoalbuminemia, hypocalcemia, hypoglycemia, and anemia were all taken into account while calculating the frequency and percentage. Researchers studied the biochemical profiles of malnourished infants by dividing SAM patients into groups based on age, gender, gestational age, birth weight, mother's parity, delivery technique, education level of the mother, and where the mother lived (rural or urban). Children with malnutrition were studied to see how these factors affected their biochemical profile. Post-stratification In this case, the Chi-Square test has to be used. The researchers regarded significant results as those with a p-value of 0.05 or lower. Tables, graphs, and charts were used to illustrate all of the data.

## RESULTS

In this study, 31 of the 161 children were in the age range 1 years, 77 of the children were in the age range 1-3 years, and 53 of the children were in the age range 4-5 years, with a mean age of 3 years and a standard deviation of 2.71. According to our analysis, there were 61 boys and 100 girls among the 161 children we studied. 105 (65%) of the 161 children studied had gestational ages of less than 37 weeks, whereas 56 (35%) had gestational ages of more than 37 weeks. Pregnancy was 37 weeks, with a standard deviation of 4.32 weeks. In a study of 161 children, the average birth weight was less than 2.5 kilograms in 97 of the children, while the average birth weight in 64 of the children was greater than 2.5 kilograms. Mean birth weight 2.5 Kgs with SD ± 0.341.Status of maternal parity among 161 mothers was analyzed as 50(31%) mother were primary para while 111(69%) mothers were multi para. Status of Mode of delivery among 161 mothers was analyzed as 108(67%) mother had spontaneous deliodery while 53(33%) mothers had cesarean section.Status of maternal education among 161 children was analyzed as 93(58%) mothers were illiterate, 39(24%) mother had primi education, 29(18%) mothers had secondary education.Status of maternal residence among 161 children was analyzed as 106(66%) mothers were from rural areas whie 55(34%) mother were from urban areas. Biochemical profile of 161 children with severe acute malnutrition was analyzed as hyponatremia was 23(14%) hypokalemia was 109(68%), hypochloremia was 26(16%), hypoalbuminemia was 11(7%), hypocalcemia was 56(35%), hypoglycemia was 24(15%) and anemia was 158(98%). Stratification of biochemical profile with respect to age, gender, gestational age, birth weight, mother's parity, mode of delivery, mother education status, mother residence (rural or urban) is given in table 1-8.

Table 1: Stratification of biochemical profile w.r.t age (n=161)

| Biochemical profile | | <1 year | 1-3 years | 4-5 years | Total | P values |
|---|---|---|---|---|---|---|
| hyponatremia | Yes | 4 | 11 | 8 | 23 | 0.9624 |
| | No | 27 | 66 | 45 | 138 | |
| Total | | 31 | 77 | 53 | 161 | |
| hypokalemia | Yes | 21 | 52 | 36 | 109 | 0.9989 |
| | No | 10 | 25 | 17 | 52 | |
| Total | | 31 | 77 | 53 | 161 | |
| hypochloremia | Yes | 5 | 12 | 9 | 26 | 0.9776 |
| | No | 26 | 65 | 44 | 135 | |
| Total | | 31 | 77 | 53 | 161 | |
| hypoalbuminemia | Yes | 2 | 5 | 4 | 11 | 0.9688 |
| | No | 29 | 72 | 49 | 150 | |
| Total | | 31 | 77 | 53 | 161 | |
| Hypoglycemia | Yes | 5 | 12 | 7 | 24 | 0.9116 |
| | No | 26 | 65 | 46 | 137 | |
| Total | | 31 | 77 | 53 | 161 | |
| Hypocalcemia | Yes | 11 | 27 | 18 | 56 | 0.9875 |
| | No | 20 | 50 | 35 | 105 | |
| Total | | 31 | 77 | 53 | 161 | |
| Anemia | Yes | 30 | 76 | 52 | 158 | 0.7989 |
| | No | 1 | 1 | 1 | 3 | |
| Total | | 31 | 77 | 53 | 161 | |

Table 2. Stratification of biochemical profile w.r.t gender (n=161)

| Biochemical profile | | Male | Female | Total | P values |
|---|---|---|---|---|---|
| hyponatremia | Yes | 9 | 14 | 23 | 0.8944 |
| | No | 52 | 86 | 138 | |
| Total | | 61 | 100 | 161 | |
| hypokalemia | Yes | 41 | 68 | 109 | 0.9175 |
| | No | 20 | 32 | 52 | |
| Total | | 61 | 100 | 161 | |
| hypochloremia | Yes | 10 | 16 | 26 | 0.9475 |
| | No | 51 | 84 | 135 | |
| Total | | 61 | 100 | 161 | |
| hypoalbuminemia | Yes | 4 | 7 | 11 | 0.9140 |
| | No | 57 | 93 | 150 | |
| Total | | 61 | 100 | 161 | |
| Hypoglycemia | Yes | 9 | 15 | 24 | 0.9661 |
| | No | 52 | 85 | 137 | |
| Total | | 61 | 100 | 161 | |
| Hypocalcemia | Yes | 21 | 35 | 56 | 0.9408 |
| | No | 40 | 65 | 105 | |
| Total | | 61 | 100 | 161 | |
| Anemia | Yes | 60 | 98 | 158 | 0.8696 |
| | No | 1 | 2 | 3 | |
| Total | | 61 | 100 | 181 | |

Table 3. Stratification of biochemical profile w.r.t gestational age (n=161)

| Biochemical profile | | ≤ 37 weeks | > 37 weeks | Total | P values |
|---|---|---|---|---|---|
| hyponatremia | Yes | 15 | 8 | 23 | 1.0000 |
| | No | 90 | 48 | 138 | |
| Total | | 105 | 56 | 161 | |
| hypokalemia | Yes | 71 | 38 | 109 | 0.9754 |
| | No | 34 | 18 | 52 | |
| Total | | 105 | 56 | 161 | |
| hypochloremia | Yes | 17 | 9 | 26 | 0.9844 |
| | No | 88 | 47 | 135 | |
| Total | | 105 | 56 | 161 | |
| hypoalbuminemia | Yes | 7 | 4 | 11 | 0.9091 |
| | No | 98 | 52 | 150 | |
| Total | | 105 | 56 | 161 | |
| Hypoglycemia | Yes | 16 | 8 | 24 | 0.8716 |
| | No | 89 | 48 | 137 | |
| Total | | 105 | 56 | 161 | |
| Hypocalcemia | Yes | 36 | 20 | 56 | 0.8561 |
| | No | 69 | 36 | 105 | |
| Total | | 105 | 56 | 161 | |
| Anemia | Yes | 103 | 55 | 158 | 0.9575 |
| | No | 2 | 1 | 3 | |
| Total | | 105 | 56 | 161 | |

Table 4. Stratification of biochemical profile w.r.t brith weight (n=161)

| Biochemical profile | | ≤ 2.5 Kgs | > 2.5 Kgs | Total | P values |
|---|---|---|---|---|---|
| hyponatremia | Yes | 14 | 9 | 23 | 0.9475 |
| | No | 83 | 55 | 138 | |
| Total | | 97 | 64 | 161 | |
| hypokalemia | Yes | 65 | 44 | 109 | 0.8173 |
| | No | 32 | 20 | 52 | |
| Total | | 97 | 64 | 161 | |
| hypochloremia | Yes | 16 | 10 | 26 | 0.8833 |
| | No | 81 | 54 | 135 | |
| Total | | 97 | 64 | 161 | |
| hypoalbuminemia | Yes | 7 | 4 | 11 | 0.8119 |
| | No | 90 | 60 | 150 | |
| Total | | 97 | 64 | 161 | |
| Hypoglycemia | Yes | 14 | 10 | 24 | 0.8353 |
| | No | 83 | 54 | 137 | |
| Total | | 97 | 64 | 161 | |
| Hypocalcemia | Yes | 34 | 22 | 56 | 0.9297 |
| | No | 63 | 42 | 105 | |
| Total | | 97 | 64 | 161 | |
| Anemia | Yes | 95 | 63 | 158 | 0.8186 |
| | No | 2 | 1 | 3 | |
| Total | | 97 | 64 | 161 | |

Table 5. Stratification of biochemical profile w.r.t mother parity (n=161)

| Biochemical profile | | Primi para | Multi para | Total | P values |
|---|---|---|---|---|---|
| hyponatremia | Yes | 7 | 16 | 23 | 0.9445 |
| | No | 43 | 95 | 138 | |
| Total | | 50 | 111 | 161 | |
| hypokalemia | Yes | 34 | 75 | 109 | 0.9566 |
| | No | 16 | 36 | 52 | |
| Total | | 50 | 111 | 161 | |
| hypochloremia | Yes | 8 | 18 | 26 | 0.9724 |
| | No | 42 | 93 | 135 | |
| Total | | 50 | 111 | 161 | |
| hypoalbuminemia | Yes | 3 | 8 | 11 | 0.7787 |
| | No | 47 | 103 | 150 | |
| Total | | 50 | 111 | 161 | |
| Hypoglycemia | Yes | 7 | 17 | 24 | 0.8283 |
| | No | 43 | 94 | 137 | |
| Total | | 50 | 111 | 161 | |
| Hypocalcemia | Yes | 17 | 39 | 56 | 0.8887 |
| | No | 33 | 72 | 105 | |
| Total | | 50 | 111 | 161 | |
| Anemia | Yes | 48 | 110 | 158 | 0.1784 |
| | No | 2 | 1 | 3 | |
| Total | | 50 | 111 | 161 | |

Table 6: Stratification of biochemical profile w.r.t mode of delivery (n=161)

| Biochemical profile | | Spontaneous delivery | Caesrean section | Total | P values |
|---|---|---|---|---|---|
| hyponatremia | Yes | 15 | 8 | 23 | 0.8372 |
| | No | 93 | 45 | 138 | |
| Total | | 108 | 53 | 161 | |
| hypokalemia | Yes | 73 | 36 | 109 | 0.9662 |
| | No | 35 | 17 | 52 | |
| Total | | 108 | 53 | 161 | |
| hypochloremia | Yes | 17 | 9 | 26 | 0.8407 |
| | No | 91 | 44 | 135 | |
| Total | | 108 | 53 | 161 | |
| hypoalbuminemia | Yes | 7 | 4 | 11 | 0.8011 |
| | No | 101 | 49 | 150 | |
| Total | | 108 | 53 | 161 | |
| Hypoglycemia | Yes | 16 | 8 | 24 | 0.9626 |
| | No | 92 | 45 | 137 | |
| Total | | 108 | 53 | 161 | |
| Hypocalcemia | Yes | 38 | 18 | 56 | 0.8783 |
| | No | 70 | 35 | 105 | |
| Total | | 108 | 53 | 161 | |
| Anemia | Yes | 106 | 52 | 158 | 0.9877 |
| | No | 2 | 1 | 3 | |
| Total | | 108 | 53 | 161 | |

Table 7: Stratification of biochemical profile w.r.t maternal education (n=161)

| Biochemical profile | | Illiterate | Primary | Secondary | Total | P value |
|---|---|---|---|---|---|---|
| Hyponatremia | Yes | 13 | 6 | 4 | 23 | 0.9746 |
| | No | 80 | 33 | 25 | 138 | |
| Total | | 93 | 39 | 29 | 161 | |
| Hypokalemia | Yes | 63 | 26 | 20 | 109 | 0.9800 |
| | No | 30 | 13 | 9 | 52 | |
| Total | | 93 | 39 | 29 | 161 | |
| Hypochloremia | Yes | 15 | 6 | 5 | 26 | 0.9790 |
| | No | 78 | 33 | 24 | 135 | |
| Total | | 93 | 39 | 29 | 161 | |
| Hypoalbuminemia | Yes | 6 | 3 | 2 | 11 | 0.9672 |
| | No | 87 | 36 | 27 | 150 | |
| Total | | 93 | 39 | 29 | 161 | |
| Hypoglycemia | Yes | 14 | 6 | 4 | 24 | 0.9817 |
| | No | 79 | 33 | 25 | 137 | |
| Total | | 93 | 39 | 29 | 161 | |
| Hypocalcemia | Yes | 32 | 13 | 11 | 56 | 0.9192 |
| | No | 61 | 26 | 18 | 105 | |
| Total | | 93 | 39 | 29 | 161 | |
| Anemia | Yes | 92 | 38 | 28 | 158 | 0.6640 |
| | No | 1 | 1 | 1 | 3 | |
| Total | | 93 | 39 | 29 | 161 | |

Table 8. Stratification of biochemical profile w.r.t maternal residence (n=161)

| Biochemical profile | | Rural | Urban | Total | P values |
|---|---|---|---|---|---|
| Hyponatremia | Yes | 15 | 8 | 23 | 0.9459 |
| | No | 91 | 47 | 138 | |
| Total | | 106 | 55 | 161 | |
| Hypokalemia | Yes | 72 | 37 | 109 | 0.9331 |
| | No | 34 | 18 | 52 | |
| Total | | 106 | 55 | 161 | |
| Hypochloremia | Yes | 17 | 9 | 26 | 0.9574 |
| | No | 89 | 46 | 135 | |
| Total | | 106 | 55 | 161 | |
| Hypoalbuminemia | Yes | 7 | 4 | 11 | 0.8732 |
| | No | 99 | 51 | 150 | |
| Total | | 106 | 55 | 161 | |
| Hypoglycemia | Yes | 16 | 8 | 24 | 0.8904 |
| | No | 90 | 48 | 137 | |
| Total | | 106 | 55 | 161 | |
| Hypocalcemia | Yes | 36 | 20 | 56 | 0.7615 |
| | No | 70 | 35 | 105 | |
| Total | | 106 | 55 | 161 | |
| Anemia | Yes | 104 | 54 | 158 | 0.9756 |
| | No | 2 | 1 | 3 | |
| Total | | 106 | 55 | 161 | |

## DISCUSSION

Childhood malnutrition is one of the greatest threats to public health around the world. More than 41% of all children aged six to twenty-four months who die each year in low-income countries are thought to have died from this cause. Around 2.3 million people have died as a result of this. Many children under the age of five are suffering from malnourishment around the world. These diseases, which include pneumonia, diarrhea, malaria, the human immunodeficiency virus (HIV), sometimes known as AIDS, and measles, can place children at an elevated risk of death. Children died as a result of malnutrition 54% of the time in the year 2001, according to World Health Organization (WHO) figures. Malnutrition has impaired the growth of 39.5% of Pakistani youngsters (underweight)[1,2].

The average age was three years, and the standard deviation was two years and seventy-one days. There were around 62% of female children and 38% of male children in the overall population of kids. The biochemical profiles of 161 children diagnosed with severe acute malnutrition were investigated. Hyponatremia was found in 14% of children, 68% had hypokalemia, 16% had hypochloremia, 11% had hypoalbuminemia, 35% had hypocalcemia, and 158 had anemia (98%). In a separate investigation, Lakshmi M. and colleagues 3 evaluated the children's biochemical and nutritional status. Complete blood count, peripheral and central smear, liver function

tests, renal function tests and serum electrolytes were among the tests they performed. They also performed alkaline phosphatase and alkaline phosphatase testing. Their conclusions were same. 15% of the children had low blood sugar, 22% of the children had low potassium, 35% of the children had low calcium, 98% of the children had anemia, 7% of the children had low albumin, 14% of the children had low sodium, and 19% of the children had high sodium in their systems. The bulk of patients' blood loss was caused by microcytic hypochromic anemia (55%).

Another study by Tariq SA et al[4] investigation found that 6.8% of hypoglycemia patients, 9.5% of hypokalemia patients, 10.12% of hypocalcemia patients, 20.2% of hypoalbuminemia patients, and 8.2% of hypernatremia patients had the same findings. Thakur N. et al.5 found that children with sickle cell anemia (SAM) were more likely to suffer from micronutrient deficiencies than healthy children. Deficiencies in iron, folic acid, and vitamin B12 were among them. A protein deficiency, which can take several forms in the blood, is also more common in these people. A normocytic blood image was identified in 27.7% of patients, a microcytic hypochromic blood picture in 38.6% of cases, a megaloblastic anemia in 30.5% of cases, and a dimorphic blood picture in 3.2% of cases. We observed similar results in our own research.

## CONCLUSION

Our study concludes that the frequency of biochemical profile of children were hyponatremia was 14%, hypokalemia was 68%, hypochloremia was 16%, hypoalbuminemia was 7%, hypocalcemia was 35, hypoglycemia was 15% and anemia was 98% with SAM presenting to Lady Reading Hospital, Peshawar.

**Conflict of interest:** Nil

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