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ORIGINAL ARTICLE



BONE HEALTH ASSESSMENT AND PROFILING IN CHILDREN WITH SEVERE ACUTE MALNUTRITION STUDY FROM LARKANA.

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ABSTRACT

INTRODUCTION: Malnutrition in children is a significant public health and growth issue in Pakistan. Children who suffer from malnutrition are much more likely to die and suffer from illnesses. **OBJECTIVE:** A prospective study was conducted in a PEDS ward of Nutrition Shaikh Zaid Hospital Larkana, to determine the status of Bone Profile and associated risk factors in severe acute malnutrition in children up to 5 years of age. **METHODS:** A total of 105 patients with severe acute malnutrition (SAM) who were admitted to our PAEDS nutrition ward and met the inclusion criteria were included in the study, which lasted six months. Following a thorough history and examination, the patients' calcium, phosphorus, alkaline phosphatase, and vitamin D levels were assessed. **RESULTS:** The study examined 105 patients, mainly females, with a higher mean age and majority living in cities. Symptoms included fever, weight loss, cough, and diarrhea. Laboratory tests revealed significant biochemical imbalances, including low vitamin D levels, calcium, ALP, and phosphorus levels. These imbalances could impact health outcomes and require additional therapeutic care. The case group's vitamin D levels were significantly lower than the control group. **CONCLUSION:** The study found that the patient group had serious health imbalances, such as low levels of calcium, phosphorus, vitamin D, and ALP, which called for therapeutic care and focused interventions.

KEYWORD: Bone Profile, SAM, Vitamin D, ALP, ALT, Inorganic Phosphate

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How to Cite This Article: Mugheri IA¹, Baloch D², Ahmed J³, Tunio AA⁴, Adnan F⁵, Mallah GS⁶. **BONE HEALTH ASSESSMENT AND PROFILING IN CHILDREN WITH SEVERE ACUTE MALNUTRITION STUDY FROM LARKANA.** JPUMHS; 2025;15:01,57-63. <http://doi.org/10.46536/jpumhs/2025/15.01.596>

Received On 25.12.2024, Accepted On 15 March 2025, Published On 31 March 2025.

INTRODUCTION

Malnutrition in children is a significant public health and growth issue in Pakistan. Children who suffer from malnutrition are

much more likely to die and suffer from illnesses. Malnutrition not only raises the risk of illness and mortality, but it also results in stunted growth and poor

cognitive and behavioral development. Severe wasting (weight for height <-3 SD), mid-upper arm circumference (MUAC) $<$ or equal to 11.5 cm, or bilateral edema are indicators of severe acute malnutrition (SAM)¹. Millions of children pass away before turning five every year. Malnutrition, diarrhea, pneumonia, measles, or malaria account for seven of ten of these deaths². Vitamin and trace element deficiencies are reported to occur in SAM children³. Children must usually have healthy bones and proper skeletal growth. For healthy and growing bones, both vitamin D and calcium are essential elements⁴. Children develop rickets as a result of inadequate bone mineralization and growth plate disruption brought on by vitamin D and calcium deficiencies or disorders of phosphate metabolism⁵⁻⁶.

We postulated that malnutrition might obscure rickets' clinical manifestations as well as other biochemical indicators linked to severe acute malnutrition. Given this context, we carried out a study to evaluate vitamin D deficiency (VDD) risk factors and vitamin D levels in children with SAM. To determine the status of vitamin D levels, inorganic phosphorus, ALP and Calcium level in SAM children up to 5 years of age.

MATERIAL AND METHODS

A research with 210 participants was carried out to assess the function of Blood Vitamin D level, Inorganic phosphorus, and ALT and Calcium parameters in patients of SAM. Two groups were assigned to the cross-sectional study: 105 cases, or patients with SAM diagnosis, and 105 controls, or healthy people without a nutritional deficiency history. To collect data, a standardized questionnaire with closed-ended questions to evaluate clinical history, disease severity, and demographic data was used. By ensuring uniformity in data collection, this standardized method made it possible to compare the two groups' blood test parameters with confidence. The results were intended to help with early diagnosis and improved risk assessment techniques by illuminating

possible bone profiling indicators linked to SAM.

Selection Criteria

All children up to 60 months old who met any one of the four criteria for SAM according to World Health Organization (WHO) guidelines and were admitted to the pediatric department were included in the study; children who had received a mega dose of vitamin D within the previous six months, congenital heart disease, cerebral palsy, mal-absorption, nephrotic syndrome, and/or related systemic diseases were not included in this study.

Sample Collection

Blood should be obtained from each participant by venipuncture using sterile procedures in order to sample the serum of 105 cases and 105 control groups. Make sure the samples are placed into the proper serum collection containers. After 30 to 60 minutes of clotting at room temperature, the samples should be centrifuged to extract the serum from the blood cells. The serum should be maintained at -20°C or below until analysis, and it ought to be carefully put into aliquot tubes that have been labeled to prevent contamination. Reliable results depend on the case and control groups' samples being properly identified and handled consistently. To reduce diurnal variation, the samples from both groups are taken at the same time of day.

Statistical Analysis

Descriptive statistics (mean, standard deviation) were computed for each variable (e.g., vitamin D, ALP, inorganic phosphorus, and calcium levels) in order to statistically analyze the blood samples from the 105 case and 105 control groups. The threshold for statistical significance was $p < 0.05$.

RESULTS

The gender distribution of the 105 patients in table 1.0 showed that 40% of the patients were female (42 patients) and 60% were male (63 patients). The female patients' mean age was slightly higher at 32.9

months, whereas the male patients' mean age was 32 months. In terms of residency, 35% of patients lived in cities, whilst the bulk of patients (65%) came from rural areas. 24% of patients were admitted for the second time, whereas the majority of patients (76%) were admitted for the first time. Regarding parental education, 42%

of parents lacked formal education, whilst 58% had formal education. The largest percentage of persons with education (42%) had finished secondary school (SSC), followed by higher secondary school (HSC) (38%), and graduation (20%).

Table 1.0 Shows the Risk factor

Variable		Frequency (n=105)	Percentages
Gender	Male	63	60%
	Female	42	40%
Mean age (Month)	Male	32	
	Female	32.9	
Residency	Rural	68	65%
	Urban	37	35%
Hospitalization	1 st Time	80	76%
	2 nd Time	25	24%
Parental Education	Educated	61	58%
	Uneducated	44	42%
Education Level	SSC	26	42%
	HSC	23	38%
	Graduate	12	20%
Family Income	Low-Income family	62	59%
	Middle-class family	36	34%
	High-Income Family	7	7%

Figure 1.0 Age wise distribution

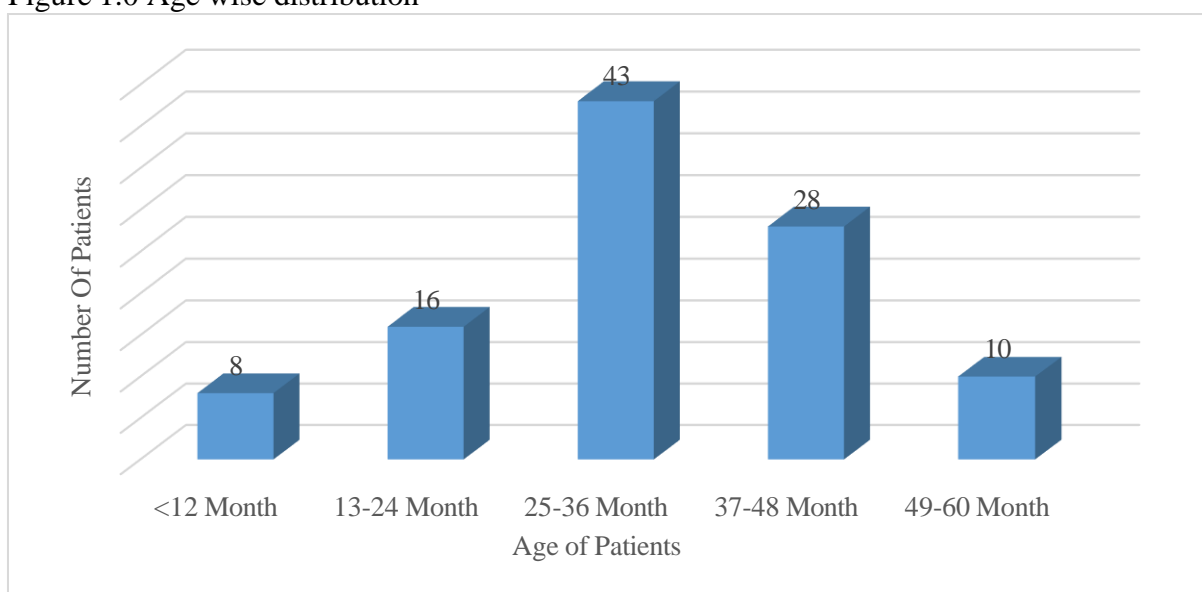


Table 2.0 displays the frequency and proportion of different symptoms that were noted in a group of patients. Fever was the most prevalent symptom, reported by 77% of patients, and weight loss was the most common, impacting 85% of patients. Cough was reported in 36 percent of the

cases, and diarrhea was reported in 72 percent of the cases. These results demonstrate that diarrhea, fever, and weight loss are common and important symptoms in the group under study.

Table 2.0 shows the clinical assessment of SAM Patients

Sign	Frequency	Percentages
Fever	81	77%
Cough	38	36%
Diarrhea	76	72%
Weight loss	89	85%

Figure 2.0 Show the Feeding Status

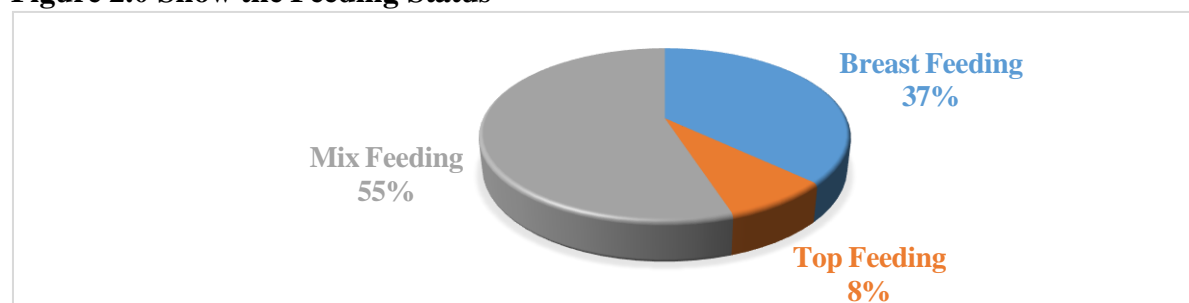


Table 3.0 shows the frequency and percentage breakdown of different laboratory test findings for four important parameters: calcium, phosphorus, vitamin D, and alkaline phosphatase (ALP). 40 percent of participants had low levels of vitamin D (less than 30 ng/ml), 51 percent had adequate levels (30–40 ng/ml), and 9 percent had high levels (>40 ng/ml). Twenty-six percent had hypocalcemia (less than 8.8 mg/dl), sixty-three percent had normal calcium levels (8.8–10.80 mg/dl), and eleven percent had hypercalcemia (more than 10.80 mg/dl). Of those with

ALP, 24% had hypophosphatemia (less than 100 U/L), 67% had euphosphatasemia (between 100 and 281 U/L), and 9% had hyperphosphatasemia (more than 282 U/L). In terms of phosphorus, 28% had hypophosphatemia (less than 3.10 mg/dL), 69.2% had normal levels (3.10 to 6.0 mg/dL), and 2.8% had hyperphosphatemia (more than 6.0 mg/dL). For these important biochemical indicators, the frequency distribution of abnormal and normal values in the research population is provided in depth by this data.

Table 3.0 shows the distribution of children on the basis of Laboratory test

Profile		Frequency(n=105)	Percentages
Vitamin D	Insufficient (<30 ng/ml)	42	40%
	Sufficient (30-40 ng/ml)	54	51%
	Excessive (>40 ng/ml)	9	9%
	Hypocalcemia (<8.8 mg/dl)	27	26%

Calcium	Eucalcemia (8.8-10.80mg/dl)	66	63%
	Hypercalcemia (>10.80 mg/dl)	12	11%
ALP	Hypophosphatasemia (<100 U/L)	25	24%
	Euphosphatasemia (100-281 U/L)	70	67%
	Hyperphosphatasemia (>282 U/L)	10	9%
Phosphorus	Hypophosphatemia (<3.10 mg/dL)	29	28%
	Normal Phosphorus (3.10 to 6.0 mg/dL)	73	69.2%
	Hyperphosphatemia (>6.0 mg/dL)	3	2.8%

Significant variations were noted in a number of biochemical markers, as Table 4.0 demonstrates. With a statistically significant difference (p-value of 0.0009), the case group's mean vitamin D level was significantly lower (29.10 ± 10.14 ng/mL) than the control group's (33.78 ± 2.90 ng/mL). Likewise, the case group's calcium levels (8.70 ± 2.26 mg/dL) were lower than those of the control group (9.46 ± 0.88 mg/dL), with a p-value of 0.001, indicating a severe calcium shortage in the patients. With a p-value of 0.0002, the case group's ALP (alkaline phosphatase) levels were

similarly considerably lower (189.15 ± 82.80 U/L) than the control group's (248.35 ± 50.29 U/L), suggesting changed enzyme activity. Lastly, the case group had lower phosphorus levels (3.61 ± 1.21 mg/dL) than the control group (4.28 ± 0.71 mg/dL), with a p-value of 0.0001, indicating a phosphorus shortage as well. Together, these findings suggest that the case group had serious biochemical imbalances, including deficits in calcium, phosphorus, vitamin D, and ALP. These imbalances may have an impact on health outcomes and necessitate additional therapeutic care.

Variable	Case (n=105) Mean \pm SD	Control (n=105) Mean \pm SD	P-Value
Vitamin D	29.10 \pm 10.14	33.78 \pm 2.90	0.0009
calcium	8.70 \pm 2.26	9.46 \pm 0.88	0.001
ALP	189.15 \pm 82.80	248.35 \pm 50.29	0.0002
Phosphorus	3.61 \pm 1.21	4.28 \pm 0.71	0.0001

DISCUSSION

Human development throughout the first five years depends on nutrition, which also influences growth and morbidity and establishes the nutritional state of adults and adolescents. SAM was shown to be more common in younger children, with 74.0% of children under the age of three having the condition. One possible explanation for this could be

because younger age groups have greater growth and nutritional requirements.⁷

Our findings about the household income and poverty level linked to SAM in children are consistent with prior research that found that families with lower monthly household incomes had more pronounced malnutrition⁸. In addition, women health workers, who are the backbone of Pakistan's primary healthcare system and

visit every home, may play a crucial role in detecting and managing SAM infections in the neighborhood⁹. Children from higher lower class families (7%) were followed by lower middle class children (34%), and lower class families (59%).

Pravana NK et al¹⁰ reported the bulk of their patients of lower category. Similar conclusions were reached in studies by Avachat et al¹¹. Better living conditions, more spending power, and parents with more up-to-date information are all linked to better socioeconomic circumstances, which may lead to a decrease in malnutrition. Of the moms in our study, 58% had completed elementary or middle school, 38% had completed intermediate school, 42% had completed graduate school, and 20% were illiterate. Nearly identical data to the current study were published by Sahoo DP et al¹². It is the reality that a mother's education is linked to greater understanding about feeding and vaccinations, a better attitude toward seeking health care, and awareness of appropriate child-rearing techniques.

According to our study, 2.8% of children had alkaline phosphate levels, 16% had low phosphorus levels, and 26% were hypocalcemic. The vitamin D levels of 40 percent of subjects were low (less than 30 ng/ml), 51 percent were sufficient (30–40 ng/ml), and 9 percent were high (>40 ng/ml). The prevalence of VDD in undernourished children was 32% in a research by Mehta S¹³. These results mirrored those observed in Pakistan (33.6%).¹⁷ VDD in children from various nations varies in prevalence; for example, 65.3% of Chinese children aged 12 to 24 months had the condition¹⁴. We found that VDD is common in SAM children, which may be associated to poor nutritional intake, poor exposure to sunlight, and possibly impaired absorption that results from enteric dysfunction or a disease process. This may be because every other investigation had various ages of children.

LIMITATIONS

The study had a modest sample size and was carried out in a single center. The study contained confounding variables that were not examined, such as newborns that were very tiny for their gestational age and may have been in their catch growth period, concomitant conditions that were not part of the exclusion criteria, and children

CONCLUSION

In conclusion, the study identified major health imbalances within the patient group, including low levels of vitamin D, calcium, ALP, and phosphorus, which may impair their general health. These results highlight the necessity of therapeutic care and focused interventions to correct these metabolic deficits.

ETHICS APPROVAL: The ERC gave ethical review approval.

CONSENT TO PARTICIPATE: written and verbal consent was taken from subjects and next of kin.

FUNDING: The work was not financially supported by any organization. The entire expense was taken by the authors.

ACKNOWLEDGEMENTS: We are thankful to all who were involved in our study.

AUTHORS' CONTRIBUTIONS:

All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated in the work to take public responsibility of this manuscript. All authors read and approved the final manuscript.

CONFLICT OF INTEREST: No competing interest declared

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