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**Research Article**

### A CROSS-SECTIONAL ASSESSMENT OF SERUM LEVELS OF CALCIUM (Ca), SODIUM (Na) AND POTASSIUM (K) IN THE SAM (SEVERE ACUTE MALNUTRITION) CHILDREN

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**Abstract:**

**Objective:** We aimed this research to assess the serum levels of calcium (Ca), potassium (K) and sodium (Na) in SAM cases and also compared their association in the absence and presence of diarrhoea.

**Methods and material:** Our cross-sectional research was carried out at Services Hospital, Lahore from March 2016 to July 2017. We included children in the age bracket of 6 – 59 months who were diagnosed with SAM and also hospitalized. Two groups were made out of the total research participants as Group – I and II having respectively diarrhoea cases and non-diarrhoea cases. Blood samples were also drained for the serum of calcium, sodium and potassium.

**Results:** A total of one hundred hospitalized children were included in the research with a mean age of  $(23.56 \pm 13.80)$  months. Male children had dominance over females as males were 62% and females were 38%. Mean values of sodium, potassium and calcium serums was respectively  $(138.46 \pm 4.14)$  mmol/L,  $(3.961 \pm 0.691)$  mmol/L and  $(8.359 \pm 0.61)$  mg/dl. Diarrhoea cases were included in Group – I (67) and Non-diarrhoea cases were included in Group – II (33). In Group I and II the mean level of sodium serum was respectively  $(138.51 \pm 4.22)$  and  $(138.36 \pm 4.05)$  mmol/L with a significant P-value of (0.10). The level of potassium serum was  $(3.89 \pm 0.67)$  and  $(4.1 \pm 0.72)$  respectively in Group – I and II with a significant P-value as (0.009). The level of calcium serum was  $(8.39 \pm 0.6)$  and  $(8.34 \pm 0.73)$  in Group – I and II with a P-Value of (0.71). Isolated hyponatremia was reported in Group – I and II respectively as 10.4% & 9.1% (P-Value = 0.83); whereas, an isolated hypokalemia in Group – I and II was respectively 26.9% & 18.2% with a significant P-value of (0.34).

**Conclusion:** SAM patients whether with diarrhoea or without diarrhoea were commonly reported for electrolytes disturbances.

**Keywords:** Diarrhea, SAM (Severe Acute Malnutrition), Electrolytes, Sodium (Na), Potassium (K), Calcium (Ca), Hypokalemia and Hyponatremia.

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## INTRODUCTION:

The imbalance between energy and nutrients is described as malnutrition which is mandatory for a normal body growth and function in the body tissues [1]. All over the world, the illness in children is attributed to numerous malnutrition contributors [2]. Protein-energy is common malnutrition among children which is a pathological state of the inadequate protein and calorie intake by the children. A worldwide death rate of 6.9 million children is reported which is caused by malnutrition which affected children of about five years age back in 2011. Majority of these deaths were caused by the malnutrition of protein energy. Stunted children are 178 million and the death count is 55 million; whereas, about 19 million cases face severe effects of the malnutrition such as death [3]. SAM is considered as most severe undernutrition. It also causes severe intellect impairment in the children in the growing age and largely affects children under five years of age. SAM has also affected Pakistan and it is graded fifth most affected country all over the world [4]. The present government is also very much serious about the stunted growth of the children. SAM patients whether with diarrhoea or without diarrhoea were commonly reported for electrolytes disturbances [1]. Level of sodium is high and potassium is low in these children instead of lower levels of serum sodium [5]. Whereas, the level of calcium may be normal in these cases [6]. SAM poses higher risks in the diarrhoea cases with increased morbidity and mortality rates than the non-diarrhoea cases [7, 8]. The disturbance of the serum electrolyte is subclinical in the malnourished children especially in the course of diarrhoea [9]. We aimed this research to assess the serum levels of calcium, potassium and sodium in SAM cases and also compared their association in the absence and presence of diarrhoea.

## METHODS AND MATERIAL:

Our cross-sectional research was carried out at Services Hospital, Lahore from March 2016 to July 2017. We included children in the age bracket of 6 – 59 months who were diagnosed with SAM and also hospitalized. Two groups were made out of the total research participants as Group – I and II having respectively diarrhoea cases and non-diarrhoea cases. Blood samples (2 ml) were also drained for the serum of calcium, sodium and potassium. An informed consent was also taken from the parents or the guardians of the children included in the research with an ethical approval from the management of the

hospital. In the presence of single or multi features the SAM was diagnosed in the children which include a weight for length divided by the total height of the children ( $< -3$ ), the circumference of the mid-upper arm ( $< 115$  mm) and both feed oedema (kwashiorkor in the presence or absence of severe wasting).

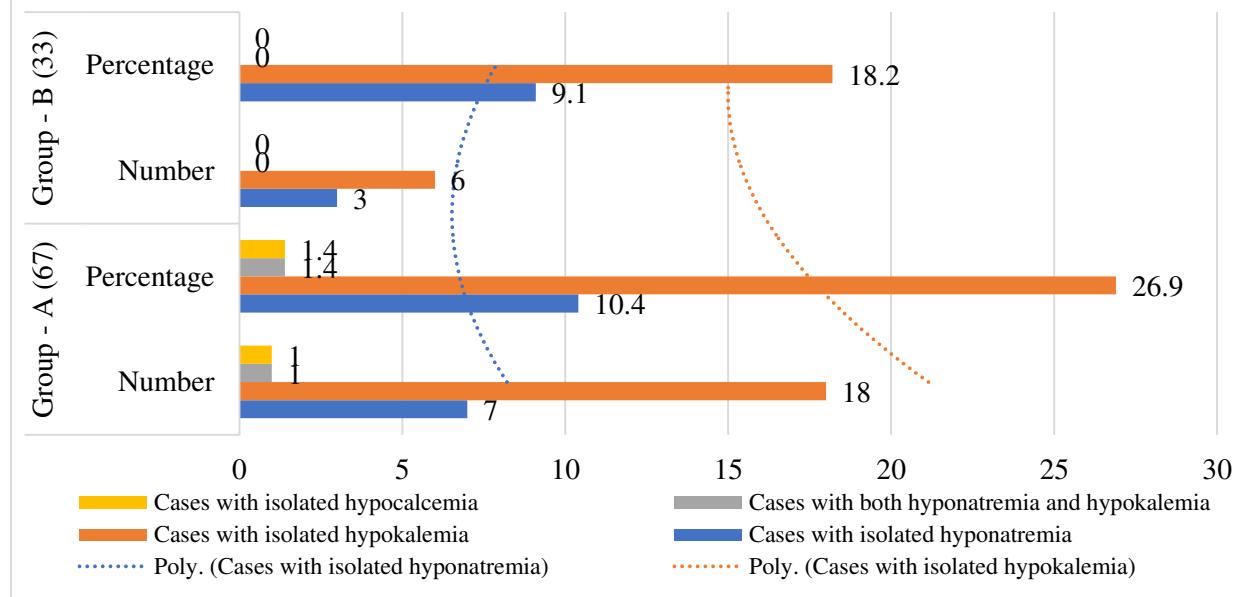
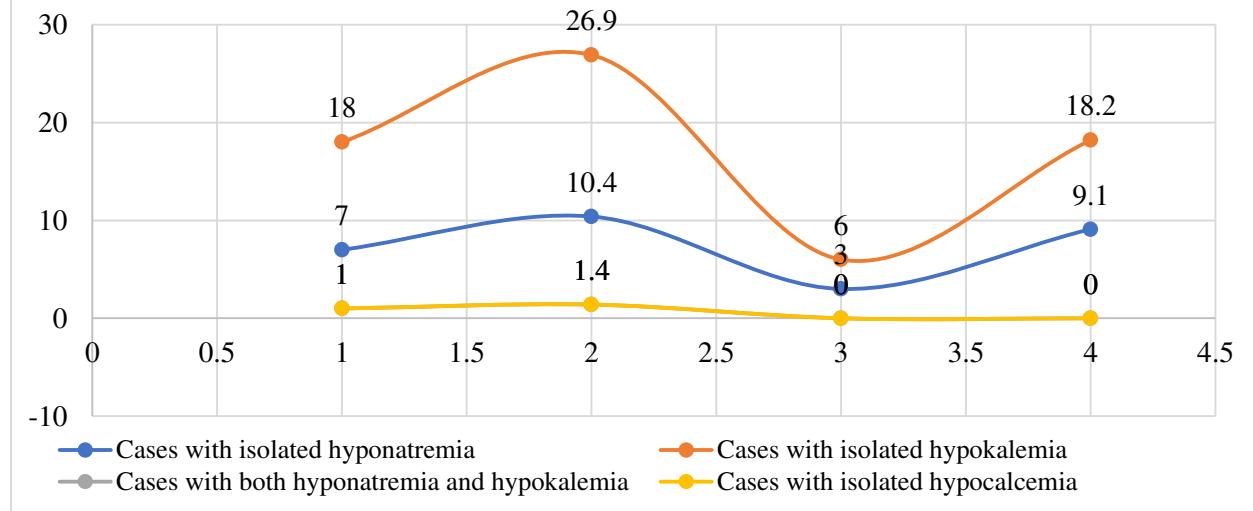
All the patients with renal disease, liver disease, diuretic therapy for children or death cases were not included in the research. Parents and guardians were asked about the demographics such as sex, age and name of the children with diarrhoea history. Diarrhoea was categorized as (loose stools more than three times in the time duration of twenty-four hours) [10]. A sample of the blood was clinically assessed through centrifuge machine (5000 rpm) for a time of five minutes. The spectrographic method was used for the analysis of the serums of calcium, sodium and potassium. Hypernatremia and Hyponatremia labelling were also carried out in the blood samples if the level of sodium was above 145 or under 135 mmol / L. Hyperkalemia and Hypokalemia was graded if the potassium was above 5.5 or under 3.5 mmol/L. Hypercalcemia and hypocalcemia were graded if calcium was above 10.5 or under 7.5 mg/dl. Data were analyzed through SPSS, Student T-test and Chi-Square test with P-value of ( $< 0.5$ ).

## RESULTS:

A total of one hundred hospitalized children were included in the research with a mean age of  $(23.56 \pm 13.80)$  months. Male children had dominance over females as males were 62% and females were 38%. Mean values of sodium, potassium and calcium serums was respectively  $(138.46 \pm 4.14)$  mmol/L,  $(3.961 \pm 0.691)$  mmol/L and  $(8.359 \pm 0.61)$  mg/dl. Diarrhoea cases were included in Group – I (67) and Non-diarrhea cases were included in Group – II (33). In Group I and II the mean level of sodium serum was respectively  $(138.51 \pm 4.22)$  and  $(138.36 \pm 4.05)$  mmol/L with a significant P-value of (0.10). The level of potassium serum was  $(3.89 \pm 0.67)$  and  $(4.1 \pm 0.72)$  respectively in Group – I and II with a significant P-value as (0.009). The level of calcium serum was  $(8.39 \pm 0.6)$  and  $(8.34 \pm 0.73)$  in Group – I and II with a P-Value of (0.71). Isolated hyponatremia was reported in Group – I and II respectively as 10.4% & 9.1% (P-Value = 0.83); whereas, an isolated hypokalemia in Group – I and II was respectively 26.9% & 18.2% with a significant P-value of (0.34).

**Table 1:** Electrolyte Abnormalities

Electrolyte abnormality	Group - A (67)		Group - B (33)		Total (100)	P- Value
	Number	Percentage	Number	Percentage		
Cases with isolated hyponatremia	7	10.4	3	9.1	10	0.83
Cases with isolated hypokalemia	18	26.9	6	18.2	24	0.34
Cases with both hyponatremia and hypokalemia	1	1.4	0	0	1	0
Cases with isolated hypocalcemia	1	1.4	0	0	1	0

**Electrolyte Abnormalities****X - Y Scatter Chart**

**DISCUSSION:**

Higher mortality rate cases of SAM were made a part of this particular research study. SAM had not been addressed as an entity by various other authors which were consulted during literature review [9, 11 – 13]. Sameen et al. included under six months aged children with SAM [14]. Memon studied the majority of electrolyte imbalance cases who also belonged to malnutrition Grade – III which was graded through Gomes taxonomy [9].

Mean age of our patients was reported as ( $23.56 \pm 13.80$ ) months; whereas Bilal and Zulqarnain reported respectively ( $1.9 \pm 1.4$ ) & ( $3.28 \pm 1.2$ ) years [11, 13]. Male children were in dominance in our research as we enrolled a 62% male case which is also comparable with the other research populations [9, 11, 13]. Memon, Bilal and Zulqarnain reported a male strength of 57%, 61.3% and 64.4% respectively [9, 11, 13].

Diarrhoea was reported in 67% patients; whereas, remaining patients were non-diarrhoea (33%). Diarrhoea was reported about 64% by Memon [9]. Hyponatremia cases were ten percent in our research; whereas, 32.5% cases were reported for hyponatremia by Bilal, Kamberi (18.10%), Sameen (22.6%) and Zulqarnain (31.1%) [11 – 14]. Seven cases were of isolated hyponatremia (10.4%) in Group – I; whereas, in Group – II only three cases were without diarrhoea (9.1%) ( $P$ -Value = 0.83). Hyponatremia was reported by Memon in SAM cases with diarrhoea and without diarrhea cases respectively as 26.56% and 13.88% with a significant  $P$ -value of ( $< 0.001$ ) [9]. In Memon used a level of sodium (under 130 mmol/L) in Hyponatremia; whereas, in another research, this level was ( $< 135$  mmol / L) [9].

We reported a total of 24% hypokalemia cases; whereas, Bilal, Kamberi, Sameen and Zulqarnain reported respectively 55%, 33.62%, 13.7% and 61.1% of patients [11 – 14]. Isolated Hypokalemia was reported in diarrhoea and SAM cases respectively 26.9% and 18.2% cases ( $P$  = 0.34). Hypokalemia was reported about 62.5% by Memon in his research where he studies diarrhoea cases; whereas, in the non-diarrhoea cases the proportion was about 22.22% with a significant  $P$ -value of ( $< 0.001$ ).

We reported no patient of hyperkalemia or hypernatremia in our research; whereas, Memon reported hypernatremia in three cases with sodium serum level ( $> 150$  mmol / L). Among these cases, one case was also reported for diarrhoea with a

significant  $P$ -Value of ( $< 0.414$ ) and no hyperkalemia incidence [9]. According to Bilal, there was no such case of hyperkalemia or hypernatremia [11].

Our research also reported a meagre number of hypocalcemia patients (1.34%); whereas, Zulqarnain reported 13.1% cases in his research [13].

**CONCLUSION:**

SAM patients whether with diarrhoea or without diarrhoea were commonly reported for electrolytes disturbances.

**REFERENCES:**

1. Memon Y, Majeed R, Ghani MH, Shaikh S. Serum electrolytes changes in malnourished children with diarrhoea. *Pak J Med Sci* 2007;23(5):760-4.
2. World Health Organization. Pocketbook of hospital care for children: guidelines for the management of common childhood illnesses. 2nd ed. Geneva: World Health Organization; 2013.
3. Bilal A, Sadiq MA, Haider N. Frequency of hyponatremia and hypokalemia in malnourished children with acute diarrhoea. *J Pak Med Assoc*. 2016;66(9):1077-1080.
4. Kamberi TH, Azemi M, Avdiu M, Jaha VI, Uka VG. Malnourished Children with Acute Diarrhea. *Arch Dis Child* 2012; 97 (Suppl 2):302724.0675.
5. Zulqarnain A, Jaffar Z, Iqbal I. Malnourished children with diarrhoea; to assess the frequency of serum electrolytes (Na+, K+ & Ca+) disturbances. *Professional Med J*. 2015;22(5):610-614.
6. Sameen I, Moorani KN. Morbidity patterns of severely malnourished children at tertiary care hospital. *Pak Pediatr J* 2014;38(1):3-8.
7. Frenk S, Pérez-Ortíz B, Murguía T, Fajardo J, Velasco R, Sanabria T. Serum-ionized calcium in Mexican protein-energy malnourished children. *Arch Med Res*. 2000;31(5): 497-9.
8. Talbert A, Thuo N, Karisa J, Chesaro C, Ohuma E, Ignas J, et al. Diarrhea complicating severe acute malnutrition in Kenyan children: a prospective descriptive study of risk factors and outcome. *PLoS One*. 2012;7(6): e38321.
9. Irena AH, Mwambazi M, Mulenga V. Diarrhea is a major killer of children with severe acute malnutrition admitted to inpatient set-up in Lusaka, Zambia. *Nutr J*. 2011; 10:110.
10. WHO/FAO Expert Committee. WHO Tech. Rep. Ser. 1973; No. 522
11. Ezzati M, Lopez AD, Rodgers A, Vander Hoorn S, Murray CJL. Selected major risk factors and global and regional burden of disease. *Lancet* 2002; 360:1347-60

12. Bhutta ZA, Salam RA. Global nutrition epidemiology and trends. Ann Nutr Metab.2012;61 (Suppl 1):19-27.
13. Ahmed T, Hossain M, Mahfuz M, Choudhury N, Hossain MM, Bhandari N, et al. Severe acute malnutrition in Asia. Food Nutr Bull.2014;35(2 Suppl): S14-26.
14. Meffat ME, Longstaffe S, Besant J, Dureski C. Prevention of iron deficiency and psychomotor decline in high risk infants through use of iron fortified infant formula. A randomized clinical trial. J Pediatr. 1994; 125:527-34.