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Research Article

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Estimation of Magnesium Level after 14 Days of Oral Magnesium Therapy in Children with Severe Acute Malnutrition

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ABSTRACT

Background: SAM is defined by WHO weight for height or length < –3 SD or bilateral pitting oedema or MUAC < 11.5 cm for children age group between 6 to 59 months. **Aims and Objections**: To observe the effect of oral magnesium therapy in children with severe acute malnutrition (SAM) on serum magnesium level. **Material and Methods**: This study was conducted from 2020 in Department of Pediatrics, Kamla Raja Hospital, G.R.M.C., Gwalior. **Study design**: Cross sectional observational study **Sample size**: 117. **Study population**: 6 to 59 months. **Duration of study**: 2 years. **Statistical analysis**: SPSS version 25. **Methods**: Weight, height and MUAC were measure at the time of admission and after 14 days of oral magnesium therapy. **Observation and Results**: Children comprises of 117. Out of these 40 (34.2%) children were from 6 months to 12 months, 36 (30.8%) were in age group 13 to 29 months41 (35.04%) from age group 25 to 60 months. Out of 117, 61 (52.1%) were male and 56 (47.9%) were female. Mean weight were 7.02±1.85 kg on admission and increased to 7.44±1.95 kg after 14 days of oral magnesium therapy. Mean height were remained the same. The MUAC was 11.17±0.72 on admission and increased to 11.41 cm after oral therapy. **Conclusion**: Children were low MUAC, loss of subcutaneous fat, lethargy mental status have higher chances of magnesia while age, gender and edema, skin changes have no relation with serum magnesium.

Key Words: *Dugdale index, Kanawati index, Mclaran index, hypomagnesemia, SAM*

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INTRODUCTION

Who Definition of Severe Acute Malnutrtion (SAM)

Magnesium is fourth most abundant mineral and second most abundant intracellular cationin human body. Most intracellular magnesium is bound to proteins and cells with higher metabolic rates have higher magnesium. Distribution of magnesium is as follows, 50-60% of total magnesium is stored in bones, rest in muscles and other soft tissue. Magnesium is mainly present as intracellular ion and only 1% is extracellular, out of which 0.3% is circulating in serum in unbound form (active), and rest in albumin bound form and in complex with other ions. Magnesium is present in CSF in amounts higher than serum. Magnesium has many cellular functions. It has vital role in all phosphate dependent metabolic processes. Magnesium stabilizes nucleic acid structure and acts as a cofactor of enzymes involved in DNA replication and repair and gene expression. It plays an essential role in numerous cellular reactions like oxidative phosphorylation, enzymatic reactions, nucleic acid metabolism and protein synthesis. It also acts as a naturally occurring calcium channel blocker thus helps in membrane stabilization. Neuronal transmission, neuromuscular function, regulation of cardiac rhythm and regulation of metabolic pathways are main functions of magnesium.

Magnesium deficiency can occur due to various reasons like gastrointestinal causes such as short bowel syndrome, tropical sprue, gluten enteropathy and severe prolonged diarrhoea; drug like aminoglycosides, diuretics, Amphotericin B, antacids & Proton pump inhibitors; miscellaneous conditions like Severe acute malnutrition, prolonged parenteral nutrition or genetic diseases and in some physiologic conditions like pregnancy, lactation and menopause.

Both deficiency and excess of magnesium can lead to clinical symptoms in patients. Deficiency causes symptoms like congestive heart failure, acute ischemic heart disease, hypertension, asthma, neurological and neuromuscular features like irritability, lethargy/apathy, tremors, headache and muscle cramps. It can lead to various dyselectrolytemia like hypocalcemia and hypokalemia.

Patients with hypermagnesemia are treated by intravenous calcium, given either as calcium chloride or calcium gluconate repeatedly till symptoms resolve. Various magnesium salts available for treatment of hypomagnesemia are Magnesium oxide and Magnesium gluconate available as tablet, Magnesium carbonate and Magnesium citrate available as liquid and Magnesium sulphate in intravenous form.

AIMS AND OBJECTIVES

AIMS:

- To observe the effect of oral magnesium therapy in children with severe acute malnutrition (SAM) on serum magnesium level.

OBJECTIVE:

- To estimate serummagnesium level at time of admission and after giving oral magnesium for 14 days in children with severe acute malnutrition.

MATERIAL AND METHODS

This cross-sectional observational study is conducted on children admitted at SMTU,Kamla Raja Hospital, GajraRaja Medical College, Gwalior, M.P. Written informed consent from the parents or children is obtained.

SAMPLE SIZE: 117

INCLUSION CRITERIA:

- Age group 6-59 months.
- Fulfilling the SAM criteria as per WHO guidelines

EXCLUSION CRITERIA:

- Severe acute malnutrition < 6 months.
- Parents not giving consent to participate

METHODOLOGY

After obtaining the written and informed consent from the parent/ guardian of the children, a clinical evaluation was performed as per a predesigned proforma.

Height, weight, MUAC were taken before and after giving on admission and after 14 days of oral magnesium therapy.

OBSERVATION & RESULTS

This study "estimation of magnesium level after 14 days of oral magnesium therapy in children with severe acute malnutrition" is conducted in Department of Pediatrics, Kamla Raja Hospital, Gajra Raja Medical College, Gwalior in a study period of 2 years from 2020 to 2022. Observations and results obtained were as follows-

Table 1: Age wise distribution of study population (n=117)

Age group	No.	Percentage
6 month-12 months	40	34.2
13-24 months	36	30.8
25-60 months	41	35.0
Mean age	22.69±13.91 Months	

Out of 117, 40 (34.2%) children were from age group 6 months to 12 months, 36 (30.8%) children were from 13 to 24 months age group and 41 (35%) were from 25 to 60 months old.
61 (52.1%) were male and 56 (47.9%) were female out of 117

Table 2: Age group and gender wise distribution of study population (n=117)

Age group	Male (%)	Female (%)
6 month-12 months	15 (24.6%)	25 (44.6%)
13-24 months	25 (41%)	11 (19.6%)
25-60 months	21 (34.4%)	20 (35.7%)

In age group 6 to 12 months 15 (24.6%) were male and 25 (44.6%) were female, in age group 13 to 24 months 25 (41%) were male and 11 (19.6%) were female and in age group 25 to 60 months 21 934.4%) were male and 20 (35.7%) were females.

Majority of the study subjects, 94 (80.3%) were Hindu by religion, 14 (17.9%) were Muslim and 2 (1.7%) were from other religions 71 (60.7%) subjects out of total 117 were from lower socioeconomic status, 29 (24.8%) were from upper lower socioeconomic status, 13 (11.1%) were from lower middle socioeconomic status, 4 (3.4%) were from upper middle socioeconomic status and no child was from upper socioeconomic status.

According to the educational status of mother, 27 (23.1%) study subjects mother were illiterate, 37 (31.6%) received primary education, 29 (24.8%) studied till middle school, 6 (5.1%) went to high school, 14 (12%) had higher secondary education and 4 (3.4%) were graduate.

Out of 117 children, father of 10 (8.5%) children were illiterate, 41 (35%) received primary education, 31 (26.5%) studied till middle school, 19 (16.2%) went to high school, 10 (8.5%) had higher secondary education and 6 (5.1%) were graduate.

On admission 7 (6%) children had weight <5 kg that decreased to 5 (4.3%) children on day 15; majority of children 73 (62,4%) weighed between 5 to 7.5 kg on admission that decreased to 67 (57.3%) on day 15; 26 (22.2%) had weight between 7.5 to 10 kg on admission that increased to 31 (26.5%) on day 15; 11 (9.4%) had weight between 10 to 12.5 kg on admission that increased to 13 (11.1%) children on day 15 and no child had weight 12.5 kg on admission that increased to 1 (0.9%) child in weight band 12.5 to 15 kg on day 15. Mean weight was 7.02±1.85 kg on admission, that raised to 7.44±1.95 kg on day 15.

Average weight gain in children with hypomagnesemia was 0.36±0.11 kg and in children with normal magnesium level at day 15 was 0.42±0.36. This was not significant statistically (p value = 0.27)

Out of 117 study subjects, 2 (1.7%) had height between 51-60 cm, 48 (41%) had height between 61-70 cm, 29 (24.8%) had height between 71-80 cm, 26 (22.2%) had height between 81-90 cm, 9 (7.7%) gad height between 91-100 cm and 3 (2.6%) children had height >100 cm on admission. Distribution of height was same on day 15. Mean height of children was found to be 75.81±10.99 cm on admission and on day 15Most of study subjects, 112 (95.7%) had weight for height <-3 SD and remaining 5 (4.3%) had weight for height between -3 SD to -2 SD on admission. At day 15, 83 (70.9%) children had weight for height <-3 SD, 32 (27.4%) had weight for height between -3 SD to -2 SD, 1 (0.9%) had weight for height between -2SD to -1SD and -2SD to -1SD each.

Mean magnesium level for 112 study subjects with weight for height <-3SD was 1.862±0.236 and for 5 children with weight for height between -3SD to -2SD, was 1.920±0.13. P value was 0.56 suggesting that relation between weight for height and serum magnesium was not significant.

Table 3: MUAC on admission and at day 15 in study population (n=117)

MUAC	**On admission**	**At day 15**
<11.5 cm	77 (65.8%)	59 (50.4%)
11.5-12.5 cm	36 (30.8%)	49 (41.9%)
>12.5 cm	4 (3.4%)	9 (7.7%)
Mean±SD	11.17±0.72	11.41±0.72

MUAC was<11.5 cm for 77 (65.8%) study subjects on admission and 59 (50.4%) study subjectson day 15, 36 (30.8%) had MUAC between 11.5-12.5 cm on admission that increased to 49 (41.9%) at day 15 and 4 (3.4%) had MUAC >12.5 cm on admission that increased to 9 (7.7%) on day 15.
Mean MUAC on admission was 11.17±0.72 cm, that increased to 11.41±0.72 at day 15.

Table 4: Correlation between Mg level and MUAC

		Mg level
Age in years	r value	0.16
	P value	0.06
MUAC	r value	**0.55**
	P value	**<0.001**

P value of <0.001 suggests significant correlation between MUAC and serum magnesium with correlation factor of 0.55.

Table 5: Association between Mg level and MUAC (n=117)

	Mg level		**P value**
	Hypomagnesemia (20)	**Normal mg level (97)**	
MUAC at admission	10.55±0.69	11.30±0.65	**<0.01**
MUAC at day 15	10.77±0.71	11.54±0.65	**<0.01**

MUAC at admission was significantly lesser in subjects with hypomagnesemia (10.55±0.69) compared to subjects with Normal mg level (11.30±0.65). This difference was statistically significant (p value <0.001). Similar results were seen at day 15.

Majority of study subjects, 68 (58.1%) had height for age <-3 SD, 24 (20.5%) had height for age between -3SD to -2SD, 15 (12.8%) had height for age between -2SD to -1SD, 8 (6.8%) had height for age between -1SD to median, 1 (0.9%) child had height for age between median to +1SD and 1 (0.9%) between +3SD to +2SD. Distribution of children as per height for age remained same at day 15.

It was seen that 16 out of 68 study subjects with height for age <-3SD had hypomagnesemia, 3 out of 24 subjects with height for age between -3SD to -2SD and 1 out of 15 subjects with height for age between -2SD to -1SD had hypomagnesemia.

Dugdale index was found to be <0.0079 in 112 (95.7%) and ≥0.0079 in 5 (4.3%) children. Mean value of dugdale index was found to be 0.0068±0.0005.

Rao& Singh Index was found to be <0.14 in 109 (93.2%) children and was≥0.14 in 8 (6.8%) children out of total 117 children. Mean value of Rao& Singh Index was 0.121±0.011.

Kanawati& McLaren Index was found to be <0.25 in 32 (27.4%) children and ≥0.25 in 85 (72.6%) out of 117 children. Mean value of Kanawati& McLaren Index was 0.26±0.016.

There was significant positive correlation between Mg level and Dugdale Index (r value = 0.276; p value <0.01), and between Mg level and Kanawati& McLaren Index (r value = 0.372; p value <0.01).

Relation between Mg level and Rao and Singh index was not significant (r value= 0.078; p value = 0.4)

Out of 117 children, loss of subcutaneous fat was absent in 18 (15.4%), grade I in 51 (43.6%), grade II in 26 (22.2%), grade III in 19 (16.2%) and grade IV in 3 (2.6%) children.

It was found that 18 (15.4%) study subjects with no loss of subcutaneous fat had mean magnesium level of 1.886±0.178, 51 (43.6%) children with grade I loss of subcutaneous fat had mean magnesium level of 1.882±0.237, 26 (22.2%) children with grade II loss of subcutaneous fat had mean magnesium level of 1.907±0.179, 19 (16.2%) children with grade III loss of subcutaneous fat had mean magnesium level of 1.842±0.208 and 3 (2.6%) children with grade IV loss of subcutaneous fat had mean magnesium level of 1.233±0.152. p-value was 0.03 suggesting a significant relation between loss of subcutaneous fat and serum magnesium.84 (71.8%) study subjects were found to have non oedematous SAM and 33 (28.2%) had oedematous SAM, out of which 18 (15.4%) had mild, 13 (11.1%) had moderate and 2 (1.7%) had severe oedema.

It was observed that out of 117 children, 84 (71.8%) had non oedematous SAM with mean magnesium level of 1.8887±0.205 and 33 (28.2%) had oedematous SAM, from which 18 (15.4%) had mild oedema with mean magnesium level of 1.8528±0.221, 13 (11.1%) had moderate oedema with mean magnesium level of 1.7769±0.360 and 2 (1.7%) had severe oedema with mean magnesium level of 1.5750±0.247. p-value was 0.18 that suggesting no significant relation between oedema and serum magnesium.

Out of 84 children with non-oedematous SAM, 11 (13.1%) had hypomagnesemia and out of 33 patients with oedema 9 (27.3%) had hypomagnesemia.

No skin changes were seen in 70 (59.8%) children, 30 (25.6%) had mild skin changes, 13 (11.1%) had moderate skin changes and 4 (3.4%) had severe skin changes.

On observing association between skin changes and serum magnesium, it was found that 70 (59.8%) children had no skin changes with a mean magnesium value of 1.8771±0.199, 30 (25.6%) had mild skin changes with a mean magnesium value of 1.8933±0.244, 13 (11.1%) had moderate skin changes with a mean magnesium value of 1.8346±0.299 and 4 (3.4%) had severe skin changes with a mean magnesium value of 1.5500±0.302. p-value was 0.17 suggesting no significant relation between serum magnesium and skin changes.

Among total 117 study subjects, magnesium level was <1.7 in 20 (17.1%) children on admission and 0 children at day 15, magnesium level was 1.71-2.2 in 92 (78.6%) children on admission and 74 (63.2%) child at day 15, magnesium level was between 2.21-2.5 in 5 (4.3%) children admission and 42 children (35.9%) at day 15 and magnesium level was >2.5 in 0 children on admission and 1 child (0.9%) at day 15

Mg level was significantly increased after day 15 (2.18±0.17) compared to admission level (1.86±0.23). (p value <0.001)Out of 117 study population, 40 children were from age group 6 to 12 months with mean magnesium level of 1.858±0.225, 13-24month age group had 36 children with mean magnesium of 1.826±0.265 and 25-60 months age group had 41 children with mean magnesium level of 1.906±0.206. Correlation between age and magnesium was not significant with p value of 0.31

Mean magnesium value was 1.866±0.262 for 61 males and 56 females had a mean magnesium level of 1.864±0.196, with a p-value of 0.96 suggesting no significant correlation between magnesium level and gender.

Hypomagnesemia was significantly more common in lethargic subjects (58.8%) compared to irritable subjects (10%). This difference was statistically significant (p value <0.001).

DISCUSSION

This study "Estimation of magnesium level after 14 days of oral magnesium therapy in children with severe acute malnutrition "is conducted in SMTU, Department of Pediatrics, Kamla Raja Hospital, over a period of 2 years from 2020 to 2022 to find association of serum magnesium with different age groups, gender, weight gain, MUAC, skin changes, mental status and oedema.

In this study 117 cases are enrolled of age group 6 to 60 months. Out of 117, 40 (34.2%) are 6 to 12month old, 36 (30.8%) are 13 to 24 months old and remaining 41 (35%) are 25 to 60 months old, thus mean age of sample is 22.69±13.91 months as reported by **Khalil et. al.** [1], **Abdullah et.al.**[2]**, Kamatham M et al.**[3], **B Dakshyaniet. al. [4]** and **Hotheret.al [5].**

In present study out of 117 subjects, 61 (52.1%) are male and 56 (47.9%) are females as also reported by **B Dakshyani et. al. [4].**

Majority of the study subjects 94 (80.3%) in this study belongs to hindu religion, 21 (17.9%) are muslim and 2 (1.7%) are from other religions as also reported by **Kamatham M et al**. [**3]**.

Out of 117 study subjects in the study, maximum children are from lower socioeconomic status, followed by upper lower and there is no patient from upper socioeconomic status group. Educational qualification of father is primary education in maximum cases followed by middle school and very less no of father are graduate. Educational qualification of mother is primary education in maximum cases followed by middle school and illiteracy and a very less no of mother are graduate. This suggests that malnutrition is more prevalent in low socioeconomic status groups as also reported by **Goyal S et al. [6].**

It is observed thatstudy subjects has a mean weight of 7.02±1.85 kg on admission that increased to 7.44±1.95 kg on day 15. Mean weight gain in children with hypomagnesemiais 0.36±0.11 kg compared to 0.42±0.36 kg in children with normal magnesium level and association between magnesium level and average weight gain is not found to be statistically significant with a p-value of 0.27, suggesting that weight gain is increased by magnesium therapy irrespective of basal magnesium levels as reported by **BDakshyani et. al. [4]**and also **Khalil et. al. [1]**

In present study, mean height study population on admission is 75.81±10.99 cm and there was no change in height at day 15 as reported by **B Dakshyani et al. [4]**and also by **Blanc et al. [7].**

Maximum number of study children 112 (95.7%) in this study have weight for height <-3SD followed by 5 (4.3%) between -2SD and -3SD as reported by **Dakshyani et. al. [4]** and also by **Hother et.al. [5].**

It is observed in this study that children with weight for height <-3SD have a mean magnesium level of 1.862± 0.236 and those with weight for height between -2SD and -3SD have a mean magnesium level of 1.920±0.13. Relation between

weight for height and serum magnesium is not significant with a p-value of 0.56 as reported by **B Gaidaa M. Salehet al. [8].**

It is found that mean MUAC at admission was 11.17±0.72 cm that increased to 11.41±0.72 cmafter 14 days of oral magnesium therapy, in this study as reported by **B Dakshyani et al. [4]**and **Hother et.al. [5].**

Mean MUAC in 20 (17.1%) children with hypomagnesemiawas 10.55±0.69 on admission and 10.77±0.71 at day 15 while mean MUAC in 97 (82.9%) children with normal magnesium levels was 11.30±0.65 on admission and 11.54±0.65 at day 15 in this study. Relation between serum magnesium levels and MUAC was statistically significant with a p-value of <0.001 and a positive correlation is found between serum magnesium and MUAC as reported by **Saadia et.al. [9]** and**Lidia et.al. [10].**

In this study maximum number of children (58.1%) have height for age <-3 SD followed by 20.5% children between -3SD to -2SD further followed by 12.8% children between -2SD to -1SD followed by 6.8% between -1SD to median. 16 (23.5%) children from group with height for age <-3 SD havehypomagnesemia, followed by 3 (12.5%) children out of 24 from -3SD to -2SD had hypomagnesemia as also reported by **Amare et.al. [11]** and **Lidia et.al. [10].**

Relation between serum magnesium and various weight independent indices of severe acute malnutrition is measured in this study. Mean value of dugdale index is 0.0068±0.0005 and it has a positive correlation with serum magnesium values and is statistically significant. Mean value of Kanawati and McLaren score is 0.26±0.016 and it has a positive correlation with serum magnesium and is statistically significant. Rao and Singh index has a mean value of 0.121±0.011 and its correlation with serum magnesium is not statistically significant as also reported by**Katyalet al. [12].**

In this study 18 children have no loss of subcutaneous fat and 99 children have loss of subcutaneous fat of varying grades. Serum magnesium level is very low in children with loss of subcutaneous fat of grade IV and its relation with serum magnesium is statistically significant as also reported by **Marino et al. [13].**

84 (71.8%) study subjects in this studyhad no oedema on admission and 33 (28.2%) had mild, moderate or severe oedema on admission. Serum magnesium levels in children with non-oedematous SAM is 1.8887±0.205, and in children with mild oedema is 1.8528±0.221, in moderate oedema children magnesium level is 1.7769±0.36 and in severe oedema magnesium level is 1.5750. There is no significant relation between serum magnesium and oedema and p-value is 0.18. 11(13.1%) children out of 84 non-oedematous SAM havehypomagnesemia and 9 (27.3%) children out of 33 oedematous SAM havehypomagnesemia as reported by**Saadiaet.al. [9]**,**Ozturk [14] et.al.** and**S.K.Behera et al. [15].**

Majority of thestudy subjects 70 (59.8%) in this study have no skin changes followed by 30 (25.6%) children having mild skin changes and 4 (3.4%) children with severe skin changes. On giving oral magnesium therapy no improvement in skin changes is seen and p value is found to be insignificant. Relation of skin changes with hypomagnesemiais done for first time in our study also reported by **Abdullah etal. [2].**

Out of 117 study subjects in this study, 20 (17.1%) hadhypomagnesemia on admission that reduced to 0 children after oral magnesium therapy, maximum children had magnesium level between 1.71 to 2.2 on admission and no child had magnesium level >2.5 on admission and only 1 child is having serum magnesium >2.5 at day 15 that too without any features of hypermagnesemia as reported by **Saadia etal. [9]**, **Karakelleoglu C et al.** [31] and **Saleemet al. [16].**

Mean magnesium level on admission was 1.86±0.23 in this study, that increased to 2.18±0.17 on day 15 and this is found to be statistically significant with a p-value <0.001. Similar findings were reported in other studies like, **Khalil et al., Madhusudhan etal.** [17], **Mbetheet al. [18]**, **Ibrahim et al. [19]** and **Takajo et al. [20].**

In this study mean magnesium level for 6 to 12 months old children is 1.858±0.225, for 13 to 24 months mean magnesium level is 1.826±0.265 and for 25 to 60 month old is 1.906±0.206 and no statistically significant relation is found between age and serum magnesium levels with a p-value of 0.31. Other similar studies like **Saadia et.al.** and**ErdoganS et.al. [21]**

In present study magnesium level for males is found to be 1.866±0.262 and in female is 1.864±0.196, with no significant difference in magnesium level valueaccording to sex is seen. Similar findings were illustrated by other studies like, **S.C. Singhietal. [22]**and **Saleem etal.**

In this study mental status of children were assessed on basis of hypomagnesemia. Out of total 117, 100 (85.4%) children are classified as irritable and 17 (14.5%) as lethargic. 10 (10%) out of 100 irritable children havehypomagnesemia and 10 (58.8%) children out of lethargic group havehypomagnesemia. There was a higher prevalence of hypomagnesemia in lethargic children and it was statistically significant. **Behera et al.** reported faster and

better improvement in mental status of malnourished children after magnesium therapy as was reported by **Back et al. [23].**

CONCLUSION

This study "estimation of magnesium level after 14 days of oral magnesium therapy in children with severe acute malnutrition" is conducted in SMTU, Department of Pediatrics, Kamla Raja Hospital, over a period of 2 years from 2020 to 2022 with an objective to estimate serum magnesium level at time of admission and after giving oral magnesium for 14 days in children with severe acute malnutrition.Out of 117, 20 (17.1%) children with severe acute malnutrition havehypomagnesemia on admission and that isreduced to 0 children after 14 days of oral magnesium therapy along with a significant increase in serum magnesium levels. It is also found that children with low MUAC, loss of subcutaneous fat, lethargic mental status have a higher chance of hypomagnesemia while age, gender, presence and grade of oedema, skin changes and weight for height have no significant relation with serum magnesium levels. It is also observed that weight independent indices like dugdale index and Kanawati& McLaren index have a positive correlation with serum magnesium while Rao& Singh index does not have a relation with serum magnesium level.

RECOMMENDATIONS

This study "estimation of magnesium level after 14 days of oral magnesium therapy in children with severe acute malnutrition" is conducted in SMTU, Department of Pediatrics, Kamla Raja Hospital, over a period of 2 years from 2020 to 2022. Association of serum magnesium with age groups, gender, mean weight gain, MUAC, skin changes, mental status and oedema is observed. Recommendations based on present studyare-

- All children with severe acute malnutrition must be given oral magnesium therapy for 14 days irrespective of clinical presentation.
- Since hypomagnesemia is quite prevalent among children with severe acute malnutrition, so serum magnesium level should be assessed on admission.
- Kanawati and McLaren index, Dugdale index and MUAC can be used as preliminary tools to find malnourished children with hypomagnesemia.

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