

# Evaluation of Malnutrition in Children Admitted in Nutritional Rehabilitation Home of Pokhara Academy of Health Sciences- A Retrospective Cross-sectional Hospital Based Study.

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## ABSTRACT

**Introduction:** The burden of malnutrition is of significant concern in Nepal. The objectives of this study are to classify the nutritional status in children admitted in nutritional rehabilitation home of Pokhara Academy of Health Sciences and to relate the demographic characteristics and the effectiveness of the nutritional intervention measures on status of malnutrition which can help in the policy formulation to tackle the burden of malnutrition.

**Materials and Methods:** This is a hospital based retrospective study in which total of 238 children with malnutrition admitted in nutritional rehabilitation home of Pokhara Academy of Health Sciences during July 2014 to July 2018 were followed. The socio-demographic factors and nutritional status were analyzed at admission and at discharge using the available record. Data was analyzed using SPSS 16.

**Results:** Out of 238 malnourished children, 167(70.2%) were cases of moderate acute malnutrition and 76(29.8%) were cases of severe acute malnutrition. The mean weight at admission was 7.18±1.73 kg, mean weight at discharge was 7.82±1.82 kg and mean weight increased after nutritional intervention was 0.62 kg±0.40. The average weight gain in severe acute malnutrition was 4.7gm/kg/day. A statistically significant difference was obtained between mean weight ( $p=0.00$ ,  $t= - 24.62$ ) of children at admission and discharge. There was significant statistical difference between mean weight gain ( $p<0.05$ ,  $t= -3.1$ ) in severe acute malnutrition (0.76±0.49 kg) and in moderate acute malnutrition (0.59±0.34 kg).

**Conclusion:** Nutritional rehabilitation homes are effective in improving the nutritional status of undernourished children, more effective in severe acute malnutrition. However it is important to reassess the management protocol to meet the intake targets so that the rate of weight gain is improved.

**Keywords:** Moderate acute malnutrition; nutritional rehabilitation home; severe acute malnutrition.

## INTRODUCTION

The burden and consequences of malnutrition especially under nutrition are of significant concern for an underdeveloped country like Nepal where around 1 million children under 5 years (36 %) suffer from chronic malnutrition (stunting), 10% suffer from acute malnutrition (wasting or low weight-for-height) and 27% are underweight.<sup>1</sup> In Gandaki province, among the under 5 children the incidence of chronic malnutrition is 29%, the incidence of acute malnutrition is 6% and 15% of the under 5 children are underweight.<sup>1</sup>

Various studies show that severely wasted children have a greater than nine fold increased risk (relative risk of 9.4) of dying compared to a well-nourished child, and moderately wasted children has a threefold increased risk.<sup>2</sup> Evidences indicate that wasting or poor weight gain may lead to higher risk of stunting in children.<sup>3</sup> The occurrence of stunting, severe wasting and intrauterine growth retardation together are responsible for 21% of disability adjusted life years(DALYs) for children younger than 5 years due to diminished cognitive and physical development.<sup>3</sup>

Nepal's commitment to improving nutrition is outlined in the Multi-Sectoral Nutrition Plan II (MSNP) 2018–2022 and aims to reduce the prevalence of stunting to 28 percent and of wasting to 7 percent among children under 5, and to reduce under nutrition (BMI < 18.5) to 12 percent among women 15 to 49 years of age. For these objectives to be met, a coordinated multi-sectored, multi-stakeholder approach is instituted for a country-led, country-driven third phase of SUN (scaling up nutrition) Movement (2021-2025). Nepal though having various constraints, has made some praiseworthy changes in the past two decades. The prevalence of underweight has reduced from 42 percent to 27 percent and child wasting from 15 percent to 10 percent.<sup>1</sup> Still the current stunting rate is high and we are far from our sustainable development goals which aim to end all forms of hunger and malnutrition by 2030.<sup>4</sup> The prevalence of acute malnutrition is likely to be much more increased due to disruption in the functioning of food system and occurrence of global food emergency as a result of the current covid 19 pandemic. This current scenario has added a new and strong challenge to

sustain the progress we have made so far and is likely to unmask the iceberg of under nutrition and hidden hunger.

To address this issue, Government of Nepal has implemented various policies and one of them is integrated management of acute malnutrition (IMAM). IMAM has four components out of which Inpatient Therapeutic Care (ITC) involves management of complicated cases of severe acute malnutrition (SAM) according to WHO protocols on an inpatient basis at tertiary level facilities (hospitals) or nutrition rehabilitation homes (NRH). Nepal has around 20 nutritional rehabilitation homes for the management of severe acute malnutrition and moderate acute malnutrition in various provinces. NRH is a specialized facility intended to rehabilitate malnourished children and was initiated as a project by Olga Murray, the president of Nepal Youth Foundation in 1998 A.D. It worked with the zonal hospitals in Nepal, and was later on handed over to the government after five years of operation. To reactivate and scale up the services for the early detection and treatment of child wasting it is important to analyze the socioeconomic determinants, anthropometric indices and nutritional interventions of malnourished children. The objectives of the study are to classify malnutrition in children admitted in nutritional rehabilitation home of Pokhara Academy of Health Sciences, to relate the association of demographic characteristics and the nutritional status and to assess the effectiveness of the nutritional intervention measures on the status of malnutrition of the children.

## MATERIALS AND METHODS

This is a hospital based retrospective cross-sectional study in which total of 238 patients of severe acute malnutrition (SAM) and moderate acute malnutrition (MAM) who were less than 5 years old, were enrolled. The children were admitted in nutritional rehabilitation home(NRH) of Pokhara Academy of Health Sciences, Western Regional Hospital (PAHS, WRH) from 1st Shrawan 2071 to 32nd Aashadh 2075 BS (15th July 2014 to 14th July 2018). The study was conducted after the approval of Institutional Review Committee of Pokhara Academy of Health Sciences (reference number 2.2077/078). Inclusion criteria for study participants were weight for height below -2SD with or without

any grade of edema. Children who fall below minus two standard deviations < -2 SD to -3 SD from the median of the reference population are regarded as moderately malnourished (MAM), while those who fall below minus three standard deviations < -3 SD from the reference population median are considered severely malnourished (SAM). Children with chronic comorbidities (cerebral palsy, congenital heart disease, tuberculosis, thalassaemia, down's syndrome etc) were excluded along with children, who stayed for less than 7 days in nutrition rehabilitation home, children more than 5 years old, who developed acute complications that required transfer to intensive care or referral, children who were discharged against medical advice and children with incomplete data. 446 cases were admitted in the nutritional rehabilitation centre of Pokhara Academy of Health Sciences from 1st Shrawan 2071 to 32nd Aashad 2075 BS (15th July 2014 to 14th July 2018). During their stay in the rehabilitation home, they were managed according to the WHO protocol.<sup>5</sup> Even though the discharge criteria mandated weight for height of children to reach -1 SD, many children were discharged as per the request of the caretaker when they start taking adequate amount of food. Out of the 446 admitted children only 238 cases were included in the study according to the inclusion criteria and rest were excluded as per the exclusion criteria.

The demographic factors and nutritional status during the period of initial stage (admission) and at discharge was analyzed using available record of anthropometry indicators. The data were recorded in an Excel sheet and descriptive analysis was performed by SPSS 16. Data are presented in tables.

**RESULTS**

Out of 238 malnourished children 29.8% (41 boys and 30 girls) were SAM cases and 70.2% (81 boys and 86 girls) were MAM cases. As depicted in table number 1, overall 51.3% of the malnourished children were males and 48.7% of the malnourished children were females. Maximum number of SAM cases (74.6%) was found in the age group of 7 months to 2 years. 11 cases of SAM belonged to up to 6 months of age and 7 cases of SAM belonged to more than 2 years of age group. Among 167 MAM

cases, 3 cases were up to 6 months old, 124 (74.2%) belonged to 7 months to 2 years of age and 40 belonged to 2 to 5 years of age. Maximum numbers of the cases (54.6%) were from Kaski district, followed by Tanahun, Syangja and Lamjung. Most of the children (46.6%) stayed in the NRH for 15 to 28 days.

**Table 1:** Socio-demographic characteristics of malnourished children (n=249)

Age of the Child- ren	No	Per- cent	At admission Weight for height (Z score)<-3SD(SAM)			At admission Weight for height (Z score)-2SD to -3SD (MAM)		
			Male	Female	Total	Male	Fem- ale	Total
≤ 6 months	14	5.9%	7	4	11	2	1	3
7 to 12 months	62	26%	12	16	28	19	15	34
13 to 24 months	115	48.3%	19	6	25	40	50	90
> 24 months	47	19.8%	3	4	7	20	20	40
Total	238	100%	41	30	71	81	86	167
Percent			57.7 %	42.3 %	29.8 %	48.5 %	51.5 %	70.2 %
Add- ress								
Gandaki provi- nce	223	93.6%	37	30	67 30%	76	80	156 70%
Others	15	6.4%	4	0	4	5	6	11
Average Hospital Stay			Male	Female	Total	Male	Fe- male	Total
7 days	4	1.7%	0	0	0	1	3	4
8 to 14 days	73	30.7%	4	9	13	31	29	60
15 to 28 days	111	46.6%	21	14	35	36	40	76
>28 days	50	21%	16	7	23	13	14	27
Total	238	100%	45	31	71	81	86	167
Gender								
Female	116	48.7%	30(42.3%)			86(51.5%)		
Male	122	51.3%	41(57.7%)			81(48.5%)		
Total	238	100%	71			167		

**Table 2:** Comparison of mean weight at admission and discharge, duration of stay, and increment of weight after NRH stay according to age, gender and status of nutrition.

Variables	Mean±SD				
	Weight at Admission (kg) mean±SD	Weight at Discharge (kg) mean±SD	Duration of stay(days) mean±SD	Age at admission (months) mean±SD	Increment of weight (kg) mean±SD
SAM (≤3SD)	5.93±1.46	6.7±1.67	26.13±12.52	14.97±9.86	0.76±0.49
MAM (≤2SD)	7.7±1.56	8.3±1.66	19.63±9.67	19.75±10.77	0.59±0.34
Gender					
Male	7.34±1.88	8.0±1.92	22.3±11.62	18.74±12.15	0.66±0.43
Female	7±1.56	7.62±1.69	20.82±10.27	17.9±8.99	0.62±0.37
Age group (months)					
≤6 months	4.25±1.14	4.81±1.14	17.29±6.24	5±1.03	0.56±0.36
7 to 12	6.08±0.9	6.63±0.93	22.63±10.73	10.39±1.38	0.55±0.34
13 to 24	7.22±0.89	7.86±0.98	22.58±11.63	16.86±3.34	0.64±0.40
>24	9.38±1.7	10.16±1.69	18.96±10.38	36.36±9.17	0.77±0.46
Status of nutrition at discharge (N)					
Median (49)	7.33±1.79	8.31±1.9	24.65±10.7	17.88±10.5	0.98±0.31
ISD (115)	7.5±1.77	8.15±1.8	20.83±11.08	19.52±11.16	0.65±0.32
MAM (≤2SD) (54)	7.02±1.34	7.43±1.31	19.91±10.75	17.44±8.6	0.41±0.42
SAM (≤3SD) (20)	5.36±1.12	5.72±1.18	22.75±10.86	14.95±13.21	0.36±0.32
Overall	7.17±1.73	7.81±1.81	21.57±10.99	18.33±10.72	0.64±0.40

As shown in table number 2 the mean weight at admission was 7.17±1.73 kg. It was 7.34±1.88 kg and 7±1.56 kg for boys and girls respectively. According to the status of malnutrition at admission, it was 5.93±1.46 kg for SAM cases and 7.7±1.56 kg for MAM cases. The mean weight at discharge was 7.81±1.81 kg. It was 8.0±1.92 kg and 7.62±1.69 kg for boys and girls respectively. According to the status of malnutrition at discharge it was 6.7±1.67 kg for SAM cases and 8.3±1.66 kg for MAM cases. The mean duration of stay in the nutritional rehabilitation home was 21.57±10.99 days. The mean age of admission was 18.33±10.72 months. It was 5±1.03 months for up to 6 months, 10.39±1.38 for 7 to 12 months, and 16.86±3.34 for 13 to 24 months and 36.36±9.17 for more than 2

years of age. The highest mean increment of weight (0.98±0.31 kg) was seen in children who attained median in the Z score after nutritional intervention in the NRH with rate of weight gain was 5.6gm/kg/day. The mean increment of weight was 0.76±0.49 kg for SAM cases and 0.59±0.34 kg for MAM cases, overall being 0.64±0.4 kg.

**Table 3:** Association between demographic characteristics and nutritional status of the children at admission

Variables	Status of malnutrition at admission		Chi square Value	p value
	MAM	SAM		
Gender			1.704	0.205
Female	86(74.1%)	30(25.9%)		
Male	81(66.4%)	41(33.6%)		
Age			31.457	0.000
≤6 months	3(21.4%)	11(78.6%)		
7 to 12 months	35(54.8%)	29(45.2%)		
13 to 24 months	92(78.3%)	26(21.7%)		
> 24 months	43(85.1%)	10(14.9%)		
Address			0.077	0.520
Gandaki Pradesh	156(70.0%)	67(30.0%)		
Others	13(76.5%)	4(23.5%)		
Average NRH stay			14.329 (Likelihood Ratio)	0.004
7 days	4(100%)	0		
8 to 14 days	60(82.2%)	13(17.8%)		
15 to 28 days	76(68.5%)	35(31.5%)		
>28 days	27(54%)	23(46%)		

As shown in table number 3, among the children who attended the NRH, 78.6% of up to 6 months of age presented with severe acute malnutrition while 78.3% of 13 to 24 months and 85.1% of more than 24 months presented with moderate acute malnutrition. There was significant statistical association of age of children with their nutritional status at admission (chi square 31.457, p = 0.00). However there was no statistical association between the gender, address and status of malnutrition of the children at the time of discharge.

Table 4: Association between average weight increment and duration of hospital stay of children (n=249)

Duration of NRH stay	Average weight increment after nutritional intervention		Chi square value	p value
	≤ 0.64 kg	>0.64 kg		
Up to 28 days	110(58.5%)	78(41.5%)	14.733	0.000
>28 days	14(28%)	36(72%)		

In table number 4, it is shown that 72% of children gained more than 0.64 kg(mean increment weight after stay in NRH) after staying for more than 28 days while only 41.5% of children who stayed for less than 28 days gained the same. It shows that average weight increment is significantly associated with duration of hospital stay of children (chi square value 14.733, p value =0.001).

Table 5: Effectiveness of nutritional intervention among malnourished children

Status of malnutrition at discharge	Number (%)	Change in weight for height Z score (SD)	Number (%)	Mean weight difference	(f) Anova value	p value
No malnutrition	164 (68.9%)	No improvement	52 (21.8%)	0.25±0.25	54.64	0.000
Moderate acute malnutrition	54 (22.6%)	SAM to MAM, SAM to no malnutrition	51 (21.5%)	0.92±0.45		
Severe acute malnutrition	20 (8.5%)	MAM to no malnutrition	135 (56.7%)	0.68±0.30		
Total	238 (100%)	Total	238	0.64±0.40		

Anova test, confidence interval= 95%, statistical significant ≤0.05

As shown in table 5, after the nutritional intervention 68.9% of children had no degree of malnutrition at the time of discharge while 8.5% were still severely malnourished. There was statistically significant association (f=54.64, p<0.001) of nutritional intervention on weight increment in malnourished children as 51 cases

of SAM improved to either MAM or with no malnutrition and 135 cases of MAM improved to no malnutrition after the nutritional rehabilitation.

## DISCUSSION

Among the 238 cases enrolled in the study, majority of children (70.2%) were cases of moderate acute malnutrition and 29.8% were cases of severe acute malnutrition. The difference between the incidence of SAM and MAM is comparable to the national data which is 10% and 2% respectively.<sup>1</sup> In a similar study done in India, 80% of the cases were severely malnourished and 20% were moderately malnourished.<sup>6</sup>

The total number of boys who were SAM cases was 41(57.7%) and of girls were 30(42.3%). There was a slight preponderance of boys in SAM cases which may be due to parent’s preferential concern for the male child for better medical care due to social customs. This difference was not statistically significant both in MAM and SAM which is in accordance with the data of NDHS 2016 (male 9.5%, female 9.8%).<sup>1</sup> A study in Zambia in 2014 also had a male predominance with no statistically significant difference.<sup>7</sup> Similar study done in Cameroon and Nigeria found a slight female preponderance in the malnourished children.<sup>8,9</sup>

The present study findings show that major proportion of malnutrition (both of SAM and MAM) is seen in between 13 to 24 months of age (48.3%) and was statistically significant (chi square 29.248, p = 0.000) with majority of cases being in the age group of 7 months to 24 months (72.36%). In a study done in Bangladesh 66% of the children affected were less than 2 years.<sup>10</sup> Similar studies in India showed 40% of malnourished children belonged to the age group of 13 to 24 months and 20% were of age 25 to 36 months.<sup>11</sup> Inadequate exclusive breast feeding in the first 6 months and inappropriate complementary feeding practices may be the cause.

There was significant difference in duration of stay in MAM(mean 19.6± 9.67days) and SAM (mean 26.13 ±12.52days) cases (p=0.00, t= -3.9, CI = 95%) with mean duration of stay being 21.57±10.99

days which is much less than in earlier programs for children with severe Protein Energy Malnutrition that range from 6 weeks to 8 months.<sup>12</sup> In another study done in Ghana effective length of stay was  $1.4 \pm 0.1$  months.<sup>13</sup>

The average weight gain for the study group during their stay at the rehabilitation home was 4.13g/kg/day; for boys the average weight gain being 4.03g/kg/day and for girls 4.25g/kg/day. However the average weight gain in SAM cases was 4.9gm/kg/day and for MAM it was 3.9gm/kg/day. In a similar study in Burkino Faso daily weight gain was 10.18 (+/-7.05) g/kg/d.<sup>14</sup> The average weight gain in a study done in India was 2.32 g/kg/day; for boys the average weight gain being 3.29 g/kg/day and for girls 2.32 g/kg/day.<sup>15</sup> Weight gain is considered poor if  $< 5$  g/kg per day; moderate if (5–10) g/kg per day and good if more than 10 g/kg per day with nutritional rehabilitation according to WHO guidelines.<sup>5</sup> There was significant statistical difference ( $p < 0.05$ ,  $t = 2.568$ ) between the mean weight gain in SAM cases ( $0.72 \pm 0.49$  kg) and the mean weight gain in MAM cases ( $0.58 \pm 0.34$  kg). Similar findings were reported in a study conducted in Madhya Pradesh, India.<sup>11</sup>

A statistically significant difference ( $t = -24.617$ ,  $P < 0.001$ ) was obtained between the mean weight of children at admission ( $7.17 \pm 1.73$  kg) and discharge ( $7.81 \pm 1.81$  kg). In a similar study the mean weight at admission and discharge were 6.27 Kg and 6.78Kg and the difference between both was statistically significant.<sup>6</sup> Similar significant increases in children's weight-for-age ( $P = 0.048$ ) and weight-for-height ( $P = 0.002$ ) Z-scores were found in other studies.<sup>13</sup> However in our study there was no significant difference in weight gain in male and females ( $p = 0.4$ ,  $t = 0.77$ ).

The change in the status of malnutrition after the nutritional intervention in the nutritional rehabilitation home was statistically significant ( $F = 60.567$ ,  $p = 0.000$ ). 67.9 % of children had no malnutrition at the time of discharge but 33.1% had some degree of malnutrition. A study done in Enugu showed 58.5% of recovery rate.<sup>9</sup>

## LIMITATIONS

The study is prone to observer bias as it is based on secondary data. Many children were discharged on

request without attaining the discharge criteria so the results were affected. The study has its limitations in that it was conducted in a limited group of subjects and is restricted to a few districts of the country and cannot represent the national data as a whole.

## CONCLUSION

Nutritional rehabilitation homes with their nutritional intervention play a vital role in rehabilitating the nourishment status of not only the children but also their mother/caretaker without adding financial burden to the already burdened families. The effectiveness is more obvious in severe acute malnourished child. However the average gain in weight per kg per day is still below the WHO recommendations. So it is necessary to revise and reassess the management protocol so that optimum service can be provided to the children. Furthermore it is important to strengthen nutritional rehabilitation homes so that they can be ready to tackle the surge in the degree and prevalence of malnourishment in this post covid-19 pandemic era.

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