

Implementing WHO Feeding Guidelines for Inpatient Management of Malnourished Children

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ABSTRACT

Objective: To evaluate the efficacy of adopting WHO feeding guidelines on weight gain and case fatality rate in malnourished children.

Study Design: Cross-sectional, observational study.

Place and Duration of Study: Department of Pediatrics, Dow University of Health Sciences, Karachi, from 2009 to 2010.

Methodology: Patients above 6 months and less than 5 years of age with severe malnutrition were included during the study period, acute complications were treated and nutritional rehabilitation by WHO feeding formulae was done. Demographic details, clinical features, reasons for weight gain and risk factors of mortality were analyzed.

Results: A total of 131 children were included. Mean age of children was 22 ± 18 months. There were 78% marasmic, 4% kwashiorkor and marasmic kwashiorkor 18% children. Resolution of edema took 8 ± 4 days, dermatosis cleared in 11 ± 3 days. Mean hospital stay was 10 ± 8 days. Case fatality rate was 13%. Mean weight gain was 5.25 ± 4.57 g/kg/day. Weight gain of > 5 gm/kg/day was associated with hospital stay of more than 7 days, acceptability and palatability of feed by the children and mothers and early clearance of infections.

Conclusion: Implementation of WHO feeding guidelines resulted in adequate weight gain of inpatient malnourished children, however, adequate healthcare services are available at the therapeutic feeding centers.

Key Words: WHO feeding guidelines. Malnutrition. Children. Therapeutic feeding centre.

INTRODUCTION

Despite numerous advances made in improving child health, malnutrition still remains a major issue and has a dramatic impact on childhood mortality. Pakistan like other developing countries also faces this problem with 38% children reported to be moderately or severely underweight¹ and 55% of mortality below the age of 5 years attributed to malnutrition.²

Schofield and Ashworth have demonstrated that mortality in children with severe malnutrition has remained unchanged in last 50 years which could be because of early introduction of diets high in sodium, energy and proteins, inadequate rehydration and treatment of infections.³

World Health Organization (WHO) in 1999 published a set of guidelines⁴ for inpatient management of severe malnutrition in children under 5 years of age which divides management in three phases: initial stabilization followed by rehabilitation and follow-up care. The protocols contain especially-made milk based starter and catch-up formulae for nutritional rehabilitation by the

name of F-75 and F-100.⁴ These diets contain proteins, carbohydrates and sodium according to the needs of malnourished children. It has been shown that case fatality rates have reduced from over 30% to less than 5% in hospitals that have used these formulas.¹

In 2007, these guidelines were also introduced in Civil Hospital, Karachi. However, to the best of our knowledge no attempt was made to study outcome of these case management guidelines in Civil Hospital, Karachi or elsewhere in Pakistan.

The current study was undertaken to assess the impact of giving WHO feeding formulae according to the recent guidelines, on weight gains and case fatality rates of severely malnourished children. It also aimed to assess factors associated with immediate and late deaths due to malnutrition and feasibility of implementing these guidelines in an under-resourced hospital.

METHODOLOGY

This is a cross-sectional, observational study conducted on severely malnourished children admitted in therapeutic feeding centre (TFC) of Pediatric Unit-3 at Civil Hospital, Karachi, during a period of one year. Children between 6 months to 5 years of age, admitted from outpatient department or emergency were enrolled. Children having edema due to renal, hepatic or cardiac causes were excluded. Children who left without completing the treatment protocol were excluded from the final analysis. Informed consent from the care-givers

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of the participants was taken prior to enrollment of children in the study.

A predesigned proforma was used for data collection. The data included demographic details, clinical presentation, complications, feeding details (including the type and duration of feeds), palatability of the feeding formulae (child's eagerness to drink), acceptability of the feeding formulae by the caregivers (adequate when the feeding formulae were offered according to the prescribed feeding timetable), daily weight, number of days in hospital and reason for discharge or death.

Classification of malnutrition was made according to WHO guidelines.⁴ Anthropometric measurements including weight in Kg and height in cms were used to classify grades of malnutrition.

Marasmus was defined when weight for height ratio (W/H) was < 70% (less than 3 median standard deviations) from the National Center for Health Statistics. Kwashiorkor was classified on presence of bilaterally symmetrical pedal edema or edema present on hands or face. Marasmic-kwashiorkor was labeled when simultaneous features of marasmus and kwashiorkor were present. Moderate malnutrition was diagnosed when weight/height ratio was between 75 - 80%.⁴

The nurses and doctors working in the TFC received training on the treatment protocols prior to data collection. Feeds were prepared by non-cooking recipes in two batches and were kept refrigerated at all times. Monitoring of weighing, feeding and preparation of feeds were done by doctors and nurses under direct supervision by the authors.

The children's caregivers were later asked to feed these formulae according to the instructions given to them. They were given marked feeding utensils to give precise amount. Children were weighed everyday by nurses in the morning at same time before starting their morning feed. The weight change was calculated daily in gms/kg /day.

Treatment was divided in two phases, in the initial stabilization phase, acute complications like hypoglycemia, hypothermia, severe anemia, dehydration, electrolyte imbalances, heart failure and severe infections were treated and feeding was started with F-75 feeding formula (75 Kcal/100 ml and 0.9 gm protein/100 ml). After stabilization, children were put on 2 days transition period which was then followed by rehabilitation phase. Rehabilitation comprised of free feeding with F-100 (100 Kcal/100 ml and 2.9 gm protein/100 ml) along with other food items. Caloric consumption was increased from 150 Kcal/kg to 220 Kcal/kg and protein intake was gradually increased from 2 g/kg to 5 g/kg. Tube feeding was done if child had appetite loss or mouth ulcers. Mineral mix as prescribed by WHO was not available and was replaced by

multivitamin syrups along with vitamin A and zinc supplements. Magnesium sulphate in the form of intramuscular injections was given for first 3 days. Iron supplementation was started with F-100 and dehydration was treated by giving Resomal (rehydrating solution of malnutrition). Blood transfusion was given to severely anemic children (hemoglobin less than 6 g/dl).

All children received at least 5 days of antibiotic therapy based on blood culture and sensitivity report. Electrolytes replacements with potassium and calcium syrups were given where needed. Children above 2 years of age were de-wormed with mebendazole. Children diagnosed with tuberculosis were given anti-tuberculous therapy. Vaccination status of children was updated before discharge. Complete blood analysis, urea, creatinine, electrolytes, blood culture, urine culture, chest X-rays, tests for tuberculosis and stool examination were done in all the children. Special investigations like HIV testing, echocardiography and tests for celiac disease were performed when required. The treatment and investigations were arranged from hospital funds and were free for the patients.

During hospital stay, children were involved in playful activities and mothers were counselled on feeding and hygiene practices. The discharge criteria were disappearance of edema for consecutive 3 days, return of appetite and weight gain of more than 5 gm/kg/day. Ethical approval was obtained from ethics review committee of DUHS.

The primary outcomes are case fatality rate and factors responsible for adequate weight gain in g/kg/day. The secondary outcomes are duration of resolution of edema, dermatosis and infection in days, recovery rate (children achieving more than 5 g/kg/day weight gain) and reasons for early (within 48 hours) and late deaths (after 48 hours).

To calculate the sample, approximate number of previous year's admission in the ward for the same disease, 100 was taken as the population size. Sample was calculated using:

$$n = [DEFF * Np (1-p)] / [(d^2 / Z^2 1-\alpha/2 * (N-1) + p * (1-p))]$$

with a hypothesized percentage frequency of outcome factor in the population as 50 ± 5 % and confidence level as 95%.

Data was entered and analyzed using Statistical Package for Social Sciences (SPSS) version 21. Categorical data was analyzed as proportions and percentages. Pearson's chi-square or Fisher's exact test was used to assess association between the secondary outcome and factors studied. Both univariable and multivariable binary logistic regression analyses were performed to assess the association of various factors that were significant in univariate analysis with the outcome variable. P-value < 0.05 was considered significant.

Table I: Demographic and malnutrition details of children.

Clinical variables	Number (n)	Percentage (%)
Age		
< 3 years	99	76
≥ 3 years	32	24.4
Gender		
Male	62	47
Female	69	52
Low birth weight	38	29
Type of malnutrition		
Marasmus	102	78
Kwashiokor	6	4.6
Marasmic-Kwashiokor	23	17.6
Vaccination status		
Totally vaccinated	30	23
Partially vaccinated	41	31
Unvaccinated	55	42
Missing	5	4
Stunted (< 3 years)	71	54.1
Wasted (< 3 years)	91	69.4
Rickets	83	63.4
Dermatosis	55	42
Eye changes	23	17.6
Hair changes	70	53
Dehydration	68	52
Infections		
Gastrointestinal infection (GIT)	46	35
Sepsis	35	26.7
Pneumonia	21	16
Malaria	7	5.3
Urinary tract infection (UTI)	8	6
Otitis media	5	4
Outcome		
Dead	17	13
Alive	114	87

Table II: Comparison of early and late death causes.

	Death status				p-value
	Early death		Delayed death		
	n	%	n	%	
Hypoglycemia					
Yes	7	63.60%	5	83.30%	0.600*
No	4	36.40%	1	16.70%	
Hypothermia					
Yes	7	63.60%	3	50.00%	0.644*
No	4	36.40%	3	50.00%	
Severe anemia					
Yes	7	63.60%	3	50.00%	0.644*
No	4	36.40%	3	50.00%	
Immunization					
Fully	2	22.20%	3	50.00%	0.011 ^{^^}
Partial	1	11.10%	3	50.00%	
Not done	6	66.70%	0	0.00%	
Death of siblings					
Yes	3	33.30%	1	16.70%	0.604*
No	6	66.70%	5	83.30%	
Low birth weight					
Yes	3	33.30%	3	50.00%	0.622*
No	6	66.70%	3	50.00%	
Infection system					
Pneumonia	0	0.00%	2	33.30%	
Sepsis	8	72.70%	3	50.00%	0.102

[^] p-value < 0.05; ^{*} Fisher's exact test.

Table III: Factors responsible for adequate weight gain.

	Weight gain ≥ 5 g/kg/day ^a	
	OR (95% CI)	p-value
Univariate logistic regression:		
Hospital stay		
≥ 7 days	21.82 (7.08-67.20)	< 0.001
Palatable		
Yes	4.26 (1.91-9.52)	< 0.001
Clearance of infection		
Yes	7.29 (3.28-16.19)	< 0.001
Mother acceptability		
Yes	6.10 (2.69-13.81)	< 0.001
Resolution of edema		
Yes	4.44 (0.42-47.50)	0.217
Resolution of dermatosis		
Yes	3.07 (0.91-10.37)	0.071
F75 (stabilization) days	0.99 (0.804-1.22)	0.927
F100 (rehabilitation) days	1.18 (1.03-1.36)	0.018*
Multivariate logistic regression:		
Excluding F100 Hospital stay		
≥ 7 days	7.62 (2.24-25.97)	< 0.001*
Mother acceptability		
Yes	3.58 (1.43-8.92)	0.006*

^a: Reference category is weight gain < 5 g/kg/day; ^{*} p-value < 0.05, Binary logistic regression

RESULTS

A total of 161 children were studied, out of which 131 (mean age 22 ± 18 months) completed the study (Table I) and were analysed. Thirty excluded children comprised of children who either left against medical advice or developed rapid weight gain due to massive edema.

F-75 was started in 113 (86%) and after 4 ± 2 days, continued as F-100 for 7 ± 4 days in 96 (73%). Resolution of edema was noted in 19 (79%) out of 24 (8 ± 4 days). Resolution of dermatosis was seen in 19 (42%) of 45 (11 ± 3 days). Infection cleared in 6 ± 5 days in 71 (57%) out of 125 children. Mean hospital stay was 10 ± 8 days. Recovery rate was 50% while death rate was 13%. Eleven out of 17 children had early death (within 48 hours) while 6 died after 48 hours of admission (Table II).

Mean weight gain was 5.25 ± 4.57 g/kg/day. Univariate logistic regression showed significant association of weight gain > 5 gm/kg/day with hospital stay of more than 7 days, acceptability and palatability of feed by the children and mothers and early clearance of infections. Multivariate logistic regression further showed that odds of gaining weight ≥ 5 g/kg/day was 7.62 times higher for patients who stayed in hospital for 7 or more days and was 3.6 times higher for children whose mothers accepted the feed (Table III).

DISCUSSION

The present study assessed efficacy of WHO guidelines in management of malnourished children in hospital settings. In this study, majority of children (80%) were

less than 2 years and edematous malnutrition was also more prevalent in this age group. Similar observations have been reported in other studies where causes like early disposition from breast feeding and inadequate complementary feeding were seen commonly.^{5,6} Although male (47%) and female (52%) children were equally effected in this study, female preponderance have been reported by some.⁷

Targeted weight gain, which was the main outcome, was achieved by 50% of the children studied. Major limitations identified in achieving this were inadequate hospital stay, non-palatability of feeds by the children and decreased acceptance of the feed by the caregivers. Inadequate hospital stay in most of the cases was due to socioeconomic problems that families faced while their children were in the hospital, since most parents earned their living on daily basis. The probable reasons for non-palatability and decrease acceptance of feeds by the children and their mothers could be due to diverse food habits. Children in our population are not accustomed to the taste of milk based feeding formulas solely, and are more comfortable with wheat and pulses culturally. Similar findings regarding feed acceptability and short hospital stay are reported by other countries that share similar issue of culture, taste and poverty.^{6,8,9}

Two important recommendations can be made based on these observations. Improvisation in taste of therapeutic feeding formulae can make them more palatable and culturally acceptable. Secondly, to improve on compliance, other forms of high density diets should be introduced to replace these inpatient feeds that can continue even after discharge from hospital as community rehabilitation programs. This will not only reduce the institutional cost of treatment but will also be more acceptable to the parents in low socioeconomic population. The need for shorter inpatient management of severely malnourished children has been recognized worldwide and integration of community based management of acute malnutrition (CMAM) has also been started in Pakistan.¹⁰

The impact of WHO guidelines on case fatality rates in different regions have varied ranging from 7% to 19%.¹¹⁻¹³ In this study, case fatality rate was 13%. More than half of the children who died were brought to the hospital in moribund condition. The remaining children continued to have severe infections and electrolyte imbalances and required meticulous monitoring, which was at times difficult to deliver in our under-resourced public sector hospital. Nine out of 17 deaths occurred in early hours of morning, when the already overburdened staff is involved in multiple tasks, as seen in other studies as well.^{14,15}

As reported in literature, there was an association of early deaths with younger age group (13/17), non-vacci-

nated status and acute complications (hypoglycemia, hypothermia and severe anemia).^{16,17} However, the unexpected finding was that most of these children (11/17) belonged to the non-edematous group. One would expect kwashiorkor to be more at risk for mortality as they have more sodium and water retention making them vulnerable to fluid overload and cardiac failure.¹⁸ The higher number of unvaccinated children can be due to their higher vulnerability to infections. Kelsey and James have reported similar findings in their recent work.¹⁹

Persistence of infections emerged as an important risk factor in both early and delayed deaths, 72% and 50% respectively. Several epidemiological studies have also documented high prevalence of infections in children with malnutrition.²⁰ The common infections observed in this study were gastroenteritis, sepsis and respiratory tract infections, which were also observed in other studies.^{21,22}

Ninety (68%) children were found to be suffering from moderate to severe anemia in this study, which is more than what was reported in Colombia and India where anemia was reported as 3%⁵ and 20%²³ respectively. Pakistan national nutrition survey 2011 has also reported 57% prevalence of anemia in children under 5 years of age,²⁴ which is comparable with these results. In authors' opinion iron deficient diets and co-existing worm infestations could be a reason for such high rates of anemia in our children.

CONCLUSION

Implementation of WHO feeding guidelines can result in adequate weight gain of inpatient malnourished children if the feeds are palatable to children, acceptable to caregivers and children have adequate hospital stay and early clearance of infections. Better healthcare services to reduce mortality and patients leaving against medical advice are factors that need to be controlled for improving the performance of therapeutic feeding centers.

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