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Review Article

Management of Moderate Acute Malnutrition: Comparison of Different Approaches

¹Pragati Chaudhary, ¹Mukta Agrawal and ²Rameshwar Lal Suman

¹Department of Home Science, University of Rajasthan, Jaipur, India

²Department of Pediatrics, R.N.T. Medical College, Udaipur, Rajasthan, India

Abstract

Moderate acute malnutrition (MAM) is defined as weight-for-height (WFH) between >-3 to <-2 SD. The MAM remains unidentified if height is not recorded regularly during growth monitoring. These unidentified MAM children suffer from dietary inadequacy as well as infection. If not treated timely and properly, may turn into severe acute malnutrition (SAM) which aggravates the situation. There is lacuna of proper guidelines for MAM management as compared to SAM. The nutritional needs of MAM and SAM children are different. There is need to assess the existing literature on MAM management. Various studies were reviewed for the management of MAM with various approaches such as management of MAM with nutritional counselling, along with provision of dietary supplements and management of MAM with dietary supplementation only. Nutrition education definitely improves the knowledge and practices of mothers and help in the recovery of MAM children. All type of supplementary food help to recover MAM child, however Lipid based ready-to-use therapeutic foods (RUTF)/ready-to-use supplementary food (RUSF) has better recovery rate than locally produced corn soy blend (CSB). Supplementation and counselling when used together have shown most significant improvement in the nutritional status of MAM children.

Key words: Supplementary food, nutritional counselling, moderate acute malnutrition, nutrition education and dietary inadequacy

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Corresponding Author: Pragati Chaudhary, Department of Home Science, University of Rajasthan, Room number 28, Saraswati Girls Hostel, Jaipur, Rajasthan, Pin code-302004, India Tel: 91-7023853353

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INTRODUCTION

Wasting, also known as acute malnutrition, refers to low weight-for-height (<-2 SD) where a child is too thin for his/her height, due to recent rapid weight loss or the failure to gain weight. A child who is moderately or severely wasted has an increased risk of death, but treatment is possible¹.

Wasting is an outcome of inadequate nutrition and occurrence of the diseases. Wasted children have weak immunity, slow rate of development, indicates an urgent treatment and care².

UNICEF/WHO/World Bank Group Joint Child Malnutrition Estimates, 2017 reported that out of 667 million children 50 million children do not weigh enough for their height¹. Whereas in 2016, nearly 52 million children under 5 were wasted and 17 million were severely wasted according to Global Nutrition Report, 2016².

According to National Family Health Survey (NFHS-4) in India 21% children were wasted (low weight-for-height) from which 13.5% were MAM while 7.5% were SAM³.

Although the causes are thought to be similar for children suffering with MAM and SAM, still the degree of wasting and other clinical complications are more severe in SAM children than those suffering with MAM⁴. There are many lacuna in current knowledge for prevention and treatment of MAM, number of efforts are being made for the management of SAM than of MAM⁵⁻⁷. The MAM is generally can be noticed only when the child is weighed and his/her height is recorded. If MAM is not treated timely and properly may develop into SAM.

The major risk factors leading to MAM are poor socio economic status of the family, maternal health, poor access to health care, insufficient food availability⁸, micro nutrient deficiencies⁹⁻¹⁰, poor sanitation and hygiene^{11,12}, unavailability of clean drinking water and poor coverage of immunization¹².

Morbidity, infection and illness are also other main causative factors for wasting. These factors create a vicious cycle with malnutrition. Repeated diarrheal incidents also causes wasting and these children have more chances to become malnourished than healthy children.

Poor Infant and Young Child Feeding (IYCF) practices such as delayed initiation of breast feeding, non exclusive breastfeeding^{9,12,13} and delayed and improper complementary feeding practices and poor care during illness are the other contributing factors.

Children with moderate acute malnutrition have an increased risk of mortality and if these children are left

untreated and unattended they may progress towards severe acute malnutrition (SAM). The SAM carries nine times higher risk of mortality than for a healthy children.

Several studies have reported that these SAM children are at increased risk of severe infections and different related co-morbidities. Children with SAM may develop different grades of edema¹⁴. Serum albumin level reduces in edematous severe acute malnourished children¹⁵. Diarrhea is the major infectious problem seen in SAM children, which further affect the glycemic status of SAM children. These SAM children may have low blood glucose level with severe dehydration as compared to non-SAM children¹⁶. Children with complicated SAM may develop the problem of dyselectrolytemia. Sodium disturbances in the form of hyponatremia can be seen in SAM children¹⁷. Systolic and diastolic functions of the heart is also affected by SAM. Children with SAM may have abnormally high myocardial performance index (MPI) than normal children¹⁸.

The MAM is generally not noticed by the parents and Anganwadi workers, because these children are just below the normal weight for height and may appear shorter and thin. Growth monitoring in ICDS is based only on weight-for-age. In routine Anganwadi workers assess underweight in children. In the absence of height measurement wasting remains unidentified. In addition for measurement of MUAC tri-color tape, which is used in field by ASHA for screening of SAM children is also not used by Anganwadi workers at Anganwadi centers (AWCs). However, physical and cognitive development of even such children will be affected badly and difficult to reverse. The MAM if not given due attention are likely to develop SAM.

It is much easier to improve the weight of MAM children than that of SAM children. Therefore, it is necessary to treat the malnourished children with the cost effective way. The most effective strategy to the management of MAM is to provide supplementary nutrition with counseling. The current review was collected with this point of view to compare the effect of different approaches in the management of MAM.

COMPARISON OF DIFFERENT APPROACHES

For the current review paper various search engines such as Google, Google scholar, Pub Med, Research Gate, Medline, Tylor Francis Online, Cochrane Library were visited and key words such as Supplementary food, Nutritional Counselling, Moderate Acute Malnutrition, Nutrition Education

and Dietary Inadequacy were used to collect the review. Studies that were fulfilling the criteria were included in current review paper.

Management of MAM: The management of MAM should be based on two approaches i.e., nutritional education or counselling and provision of nutrition supplements.

Nutritional recommendations for management of MAM children: Nutritional recommendations for MAM children are given in World Health Organization (WHO)¹⁹ technical report and CMAM (Community Management of Acute Malnutrition) Forum, 2014. Following recommendation are given:

Children with MAM should receive nutrient-dense foods to meet extra requirement for weight and height gain. Supplementary food for MAM children should provide energy densities between 1.5 and 2.0 kcal g⁻¹ and should not be less than 0.8 kcal g⁻¹. At least 35 and 45% energy should derived from fat and it should not go below 30%. In the fatty acids content at least 4.5% of the total energy should drive from n-6 Poly Unsaturated Fatty Acids (PUFA) and 0.5% from n-3 PUFA and ratio of linoleic and alpha-linoleic should be of 5-15. To complete protein requirement it is suggested that cereal/legume mixtures, milk and animal protein sources should be included in the diet and these sources should have protein digestibility corrected amino acid score (PDCAAS) >70%. Milk powder can be included as it helps to improve amino acid profile and source of bio available calcium and phosphorus. Lactose may help to improve the absorption of minerals and also act as prebiotic. Supplementary food should not cause any adverse effect on MAM children^{19,20}.

Recommendations for counselling: Counselling can be effective in the management of MAM. Counselling on different topics such as on diet, breast feeding, practices related to care of child should be given with food supplementation. Only that recommendations which are feasible, acceptable and affordable should be given. During counselling care giver should be told about age appropriate feeding and quantity of nutrients, energy dense foods. Different techniques such as demonstration of cooking, home visits, group counselling, meetings can be used to achieve maximum results²⁰.

Government of India has launched number of programme and policies to improve the nutritional status of

children, but the beneficiaries are not utilizing the services properly. Therefore, counselling is must needed to educate and motivate mothers so that they will provide supplementary nutrition, age appropriate IYCF practices and care. This may be most practical strategy with dietary supplementation.

Management of MAM with different approaches: Table 1 showed that only counselling have shown improvement in MAM children. Counselling helps mothers to understand the importance of appropriate infant and young child feeding practices. The data on complimentary feeding and adequate diet consumption during pre school age is very discouraging. According to NFHS-4, 42.7% children aged 6-8 months received solid or semi-solid food and breast milk, percentage of the breastfed children aged 6-23 months who received an adequate diet were found only 8.7%, while very few (14.3%) non-breastfed children aged 6-23 months received an adequate diet. Total children aged 6-23 months received an adequate diet were only 9.6%³. This shows poor awareness regarding Infant and Young Child Nutrition. Due to counselling mothers will learn to explore the available food for the preparation of energy and protein dense preparation for their children. Counselling enhances the practices of feeding timely correct nutrient dense and diverse food and help in proper nourishment of children. This can be achieved by focused and intensive age appropriate counselling.

Poor availability of food and ignorance of locally available nutrients dense food are reasons for poor IYCF practices. Supplementary feeding is a short term strategy for treatment and prevention of malnutrition. This strategy helps in recovery of MAM as it is an outcome of current malnutrition. Table 2 reveals that all supplementary food have shown improvement. RUTF/RUSF were reported more effective in recovery of MAM in comparison to locally available blends. Appropriate energy protein combination along with micro-nutrient help to regain weight and height and to control the infection. There is a need of counselling of mothers along with supplementary feeding to get best results. Other factors such as appropriate breast feeding practices, care of sick child, diarrhea management and hand hygiene can be addressed in counselling. Table 3 showed that when counselling was given along with supplementation best results were obtained because it increases the utilization of supplementary food and also improves the age appropriate IYCF practices.

Table 1: Management of MAM with counselling only
Treatment of MAM with counselling only

Reference and Place	Study subjects (age, type of malnutrition), Number of subjects, groups	Intervention	Anthropometric indices/parameters	Outcome
Ragini <i>et al.</i> ²¹ , Urban slum of Ludhiana, India	101 of MAM children in the age range of 2-5 years and their mothers residing in slum area	Nutrition and health education to mothers. Education on how to prepare different types of low cost energy-dense supplementary food stuffs	Weight-for-age, Height-for-age and weight-for-height	Health education to mothers resulted in significant improvement in the nutritional status of the study children. Post-intervention weight, height and mid upper arm circumference increased significantly (p=0.000). The effect of health education and motivation in term of compliance decline in the absence of continued reinforcement
Inayati <i>et al.</i> ²² , Nias Island, Indonesia	200 mother of mildly wasted children in the age range of 6-60 months	Weekly intensive nutrition education (INE) (n = 114) or monthly non intensive nutrition education (NNE) (n = 96)	Weight-for-height	After participating in the nutrition education program, the percentage of correct answers on nutrition knowledge and practice in the INE group was significantly higher than that in the NNE group. After the completion of the study a remarkable change for gain in knowledge and improved practice scores was observed in weekly INE group (p< 0.001). NNE group also showed improvement but that was marginal (p < .05)

Table 2: Management of MAM with supplementary food only
Treatment of MAM with supplementary foods only

Reference and Place	Study subjects (age, type of malnutrition), Number of subjects and groups	Intervention	Anthropometric indices/Parameters	Outcome
Ackatia-Armah <i>et al.</i> ²³ , Rural Mali	1264 MAM children in the age range of 6-35 months	Four dietary supplements were given • Ready-to-use, lipid-based supplementary food (RUSF) • Special corn-soy blend (CSB++) • Locally processed, fortified flour (Misola) • Locally milled flours plus oil, sugar and micronutrient powder (LMF)	Weight-for-length, MAUC	Gain in weight (kg) was higher with RUSF than with the locally processed blends and was intermediate with CSB++. When children were observed for gain in length significant difference was found in RUSF and CSB++ than LMF. Sustained recovery rates were higher with RUSF (73%) than with Misola (61%) and LMF (58%)
Steenkamp <i>et al.</i> ²⁴ , South Africa	226 MAM children in the age range of 12-60 months	RUSF (1-2 sachets of 92 g/day for 6 weeks) providing 175 kcal kg ⁻¹ /day	Weight-for-height, Height-for-age, Weight-for-age, MUAC	All anthropometric indicators improved with RUSF. At first follow up visit growth velocity was 1.52 g kg ⁻¹ /day with 7% achieved moderate growth velocity and 29% catch up growth. After 4 weeks follow-up velocity was found 1.07 g kg ⁻¹ /day, at 6 weeks it was 1.00 g kg ⁻¹ /day. Children with lower WHZ responded better to RUSF than children with high WHZ
Chang <i>et al.</i> ²⁵ , Rural Malawi	1976 MAM children in the age range of 6-59 months	Intervention was done with following three types of supplementation: • CSB (corn soy blend)+ milk and oil (CSB++) • Soy ready to use supplement • Soy whey RUSF	Weight-for-height, MUAC	More children recovered from MAM in soy/whey RUSF group and stay in well nourished (67%) than those received CSB++ (62%) or soy RUSF (59%) (p = 0.01). Soy/whey RUSF had better impact on recovery from MAM

Table 2: Continue
Treatment of MAM with supplementary foods only

Reference and Place	Study subjects (age, type of malnutrition), Number of subjects, groups	Intervention	Anthropometric indices/Parameters	Outcome
Purwestri <i>et al.</i> ²⁶ , Nias Island, Indonesia	1020 MAM children in the age range of 6-60 months	Locally produced RUSF (fortified cereal/nut/legume) were given on daily and weekly basis	Weight-for-height, Height-for-age, MUAC	Weight gain of the children in daily and weekly programs was 3.9±3.8 g kg ⁻¹ /day and 2.0±2.0, respectively. More children reached target WHZ (weight-for-height z-score) (76% vs. 35%), in daily than weekly programme. Daily supplementation had better impact on recovery of MAM as compared to weekly supplementation
Acktia-Armah <i>et al.</i> ²⁷ , Rural health centers in Diola Health District, Mali	1284 MAM children without oedema in the age range of 6-35 months	Following 4 ready to use supplements were used for experiment: • Lipid-based, RUSF (Plumpy'Sup, PS) • Special corn soy blend (CSB++) • Locally processed, fortified food (Misola) • Locally milled flours and micro nutrient powder	Weight-for-height, MUAC	The gain in weight was more in Plumpy' Sup group in comparison to other three groups (1.15±0.57, 0.96±0.55, 0.96±0.53 and 0.91±0.54 kg for respective study groups. Similar results were observed for MUAC, but length did not differ significantly among groups. Best results were observed for recovery from MAM with Plumpy' Sup, PS as compared to other 3 supplementation (71, 56, 59 and 53% for respective groups, p<0.001). Study concluded that Plumpy' Sup was found to be a effective dietary supplement as compare to other supplements
LaGrone <i>et al.</i> ²⁸ , southern Malawi	900 MAM children in the age range of 6-59 months	Comparison of corn soy blend (CSB++) with following two RUSF: • Imported soy/whey RUSF (Plumpy'Sup; nutriset) • Locally prepared soy RUSF • Intervention was done for ≤12 weeks	Weight-for-height	Recovery rate for CSB++ (85.9%) was similar to that for soy RUSF (87.7%) and soy/whey RUSF (87.9%). CSB++ group took 2 days more to recover, gain in weight was also less as compared to other two RUSF. Similar results were observed for height gain among all three groups. Study concluded that CSB++ when prepared locally was not of lower quality to a soy RUSF and imported soy/whey RUSF in promoting recovery from MAM
Karakochuk <i>et al.</i> ²⁹ , Ethiopia	1125 MAM children in the age range of 6-60 months	Ready-to-use supplementary food (Supplementary plumpy; nutriset) and the more conventional ration of corn-soya blend (CSB) for 4 months	Weight-for-height	A total of 73% of children recovered from MAM in RUSF as compared to 67% with CSB. In comparison with CSB, the treatment of MAM with RUSF shown better results in the recovery of MAM children
Talley <i>et al.</i> ³⁰ , South Darfur, Sudan	15, 51 children at length cut-off of 95 cm	Two group of supplements in Blanket Supplementary Feeding Programme (BSFP): • Lipid based Nutrient supplement (LNS) (Plumpy' doz) contains peanut paste, vegetable fat, skimmed milk powder, whey, maltodextrines, sugar and complex of minerals and vitamins (46 g or three spoonfuls of the LNS, three times per day) Improved Dry Ration (IDR) 180 g/day consisting CSB, dried skim milk powder, oil, sugar	Weight-for-height, MUAC	Increment in the WHZ with every distribution was observed. Significant differences in the mean WHZ was seen at second distribution, with LNS group having higher WHZ. Both the supplements were found to be effective, but LNS performed better than IDR in the improvement of WHZ. Study concluded that LNS may use for the prevention of acute malnutrition
Lagrone <i>et al.</i> ³¹ , Southern Malawi	2417 MAM children in the age range of 6-59 months	Weight-for-height, MUAC	Locally produced soy/peanut RUSF for 8 weeks	After 8 weeks dietary supplementation 80% children recovered from MAM. Weight, length, MUAC gain were 2.6 g kg ⁻¹ /day, 0.2, 0.1 mm/day, respectively. It was concluded that RUSF resulted in high recovery and low default rate in MAM children

Table 2: Continue
Treatment of MAM with supplementary foods only

Reference and Place	Study subjects (age, type of malnutrition), Number of subjects, groups	Intervention	Anthropometric indices/Parameters	Outcome
Matlisky <i>et al.</i> ³² , Southern region, Malawi	1362 MAM children in the age range of 6-60 months	<ul style="list-style-type: none"> • Micro nutrient-fortified CSB (80% corn 20% soy) • Soy/peanut fortified spreads • Milk peanut fortified spread (27% peanut paste, 26% soy flour) • (26% peanut paste, 25% dry skimmed milk). Vegetable oil, sugar, concentrated mineral and vitamins (calcium, Mg, K, zinc, copper, Iron, Vit. A, C, D, niacin, folic acid, thiamine, Riboflavin, Vit. B-6 and B-12) were added to both types of Fortified spreads by formulating the micronutrient mixture. Vitamin B-12 was also added in soy/peanut spread 	Weight-for-height, MUAC	Recovery rate was same in soy/peanut fortified spread (FS) group to those receiving milk/peanut FS. Children in both groups of fortified spread (either soy/peanut fortified spread or milk/peanut fortified spread) have shown better recovery as compare to CBS group (80% recovery in both FS groups vs. 72% in the CSB group). Similar results were observed for weight gain. Gain in weight for first two weeks was higher among milk/peanut FS (2.6 g/kg/day) or soy/peanut FS group (2.4 g/kg/day) as compared to CSB group (2.0 g/kg/day). Study concluded that FS have shown better recovery in MAM children then CSB supplementary food
Nackers <i>et al.</i> ³³ , Zinder region, south Niger	807 MAM children having length ranging in between 65 to less than 110 cm and in the age range of 6-59 months	Ready to use therapeutic food (RUTF) and Corn Soy Blend (CSB)-based pre mix	Weight-for-height	Recovery rate in RUTF group was 79.1% while in CSB group it was 64.4% (p<0.001). The RUTF feeding had higher recovery of MAM as compare CSB. In the CSB pre-mix group more children were transferred to inpatient therapeutic feeding center (19.1% compared to the RUTF group (9.3%) (p ¼ 0.003). The gain in weight was more in RUTF group 1.08 g/d and the length of stay was 2 weeks less in the RUTF group (p < 0.001)
Phuka <i>et al.</i> ³⁴ , Rural Malawi	176 MAM children aged 6-18 months	Micro nutrient fortified maize soy flour or ready-to-use Fortified Spread (FS) for 12 weeks	Weight-for-age, Weight-for-length, Length-for-age	Increment in the mean of weight-for-age and weight-for-length was observed at the end of the intervention. Recovery from underweight and wasting was 20 and 93% in micro nutrient fortified maize soy flour group and 16 and 75% in FS group. Both the supplements showed recovery in MAM and underweight children. The recovery from wasting was higher (93%) with feeding fortified maize soy flour as compared to ready to use fortified spread (FS) (75%) for 12 weeks. Recovery from stunting was also seen in few children
Defourny <i>et al.</i> ³⁵ , Marandi, Niger	59,698 MAM children in the age range of less than 5 years in Medecins Sans Frontiers (MSF) programme	RUTF (Plumpy' nut)	Weight-for-Height (W/H) ratio, MUAC	Result of the programme showed that cure rate of MAM children was 95.5%. Gain in weight was also good i.e., 5.28 g kg ⁻¹ /day. Approximately 75% children had a W/H ratio >85% of the NCHS reference median on discharge. Results confirm the effectiveness of RUTF in the treatment of MAM
Ciliberto <i>et al.</i> ³⁶ , Southern Malawi	1178 wasted children with or without mild oedema in the age range of 10-60 months	<ul style="list-style-type: none"> • Children were systematically allotted in two groups- • 186 children for standard inpatient therapy • 992 for home based therapy with ready to use therapeutic food (RUTF) (maize/20% soy blended flour) 	Weight-for-height, MUAC	Home based therapy with RUTFs effective to achieve weight-for-height z score in comparison to standard inpatient therapy (79% compared with 46%; p,0.001) and were less likely to relapse or die (8.7% compared with 16.7%; p 0.001). Gain in weight, height and mid upper arm circumference was more in RUTF group than in children who received standard care

Table 3: Management of MAM with counselling and dietary supplementation
Treatment of MAM with counselling and dietary supplementation

Reference and Place	Study subjects (age, type of malnutrition), Number of subjects, groups	Intervention	Anthropometric indices/parameters	Outcome
Scherbaum <i>et al.</i> ²⁷ , Nias Island	111 children with Weight-for-Height less than -1.5 SD in the age range of 6-60 months and their mothers	Two nutritionally comparable forms of locally produced ready-to-use foods • Peanut/milk-based spreads (PM-S) (n = 29) 2A) cereal/nut/legume-based biscuits (CNL-B) (n=44) 2B) Cereal/nut/legume-based biscuits with intensive nutrition education programme (CNL-B+INE) (n = 38)	Weight-for-height	Both the group of CNL-B showed high compliance than PM-S group (CNL-B+INE = 86%, CNL-B = 84%, PM-S = 45%). Weight gain and mean WHZ at the time of discharge was higher in both supplements of the CNL-B than PM-S and was highest in the CNL-B+INE than other two groups. Results showed that locally produced ready-to-use foods as biscuits or spreads are effective in the recovery of MAM children
Christian <i>et al.</i> ²⁸ , Dhaka, Bangladesh	5319 wasted and stunted children in the age range of 6-18 months	Two local ready-to-use foods (chickpea and rice-lentil based) and a fortified blended food (wheat-soy-blend, WSB) compared with Plumpy doz, all with nutrition counselling vs. nutrition counselling alone (control group)	Weight-for-length Length-for-age	Prevalence of stunting was 5-6% lower in children receiving Plumpy doz and chickpea than control group (44%). Gain in length-for-age was observed by 0.27-0.30 cm and 0.07-0.10 cm in all groups as compared to control group. Study concluded that small amount of fortified foods if given on daily basis for a year, moderately increases growth and help to recover from stunting. Study concluded that only nutrition education definitely improves the recovery of MAM. INE with nutrition supplementation had better impact. Only supplementation also improves recovery
Medoua <i>et al.</i> ³⁹ , Cameroon	81 MAM children in the age range of 25-59 months	Weight-for-height, weight-for-age, MUAC;	Improved corn soy blend (CSB+) was compared with a ready-to-use supplementary food. Every child received A daily ration of 40 kcal/kg/day for 56 days. Nutrition counselling was also given at each follow-up visit	Recovery rate was found 73 and 85% for CSB+ and RUSF, respectively. Mean duration of recovery was 44 days in RUSF and 51 days in CSB+. Higher weight gain was reported in RUSF. Mean weight gain was 1.83, 2.7 g kg ⁻¹ /day for CSB+ and RUSF. Gain in MUAC was reported as 0.10 and 0.14 mm/day in CSB+ and RUSF group. In spite of low ration size, both supplements were found to be successful in the treatment of MAM
Nikiema <i>et al.</i> ⁴⁰ , Burkina Faso.	1974 MAM children in the age range of 6-24 months	Weight-for-height, MUAC	Comparison of child centered counselling (CCC) with CSB+++ (corn soy blend with added micro nutrient) 65 g/day or locally produced RUSF (50 g/day)	After 3 months of intervention the recovery rate was higher in CSB+++ (74.5%) and RUSF (74.2%) than CCC group (57.8%). Overall 69.3% recovered from MAM. Study concluded that CSB+++ and RUSF were equally effective and showed recovery rate of 75% over a period of 3 months. Treatment of MAM with small amount of complementary food was more effective than CCC approach. Lower recovery rate in CCC group was found due to lower attendance. However recovery rate in CCC can be improved by increasing the attendance

Table 3: Continue
Treatment of MAM with counselling and dietary supplementation

Reference and Place	Study subjects (age, type of malnutrition), Number of subjects, groups	Intervention	Anthropometric indices/parameters	Outcome
Inyati <i>et al.</i> ¹¹ , Nias, Indonesia, Randomised trial	165 mildly wasted children in the age range of 6-60 months and their mothers. They were divided in two groups- Group 1: 64 children in INE and 51 in INE+MNP group Group 2: 50 children in NNE with or without MNP (50)	Two groups from Church World Project area (INE, INE+MNP), another two groups of wasted children living at distance from Church World Project area • INE group (intensive nutrition education) (n = 64) weekly • INE+MNP group (micronutrient powder) (n = 51), 7 micronutrient sachets/week, INE weekly • NNE group Intensive nutrition education monthly • NNE+MNP group • 7 MNP sachet/week, NNE once in a month	Weight-for-height, Weight and height	Higher weight gain (g/kg/day) was observed in INE+MNP group (2.2±2.1), followed by INE (1.1±0.9), NNE+MNP (0.3±0.5) and NNE (0.3±0.4) group. In INE+MNP group more children reached discharge criteria (70.6%), followed by INE (64.1%), NNE+MNP (26.0%) and 20.0% in NNE groups (p<0.001). Short duration of stay until recovery was seen in children from INE+MNP group (29.9 days), followed by INE (40.0 days), NNE+MNP (80.6 days) and NNE (86.2 days) respectively (p<0.001). Best results were observed in the INE+MNP group related to weight gain, recovery rate, length of stay and improvement of weight-for-height z-score in comparison to those in INE, NNE and the NNE+MNP groups
Roy <i>et al.</i> ¹² , Rural Bangladesh	282 MAM children in the age range of 6-24 months and their mothers	Two groups. • Intensive nutrition education (INE) to mother twice a week for three months • Nutrition education with additional supplementary feeding (INE+SF) to the children Supplementary feed included roasted and powdered rice, powdered pulses, molasses and oil in 40:20:10:6 ratios for 6 days a week Control group (nutrition education twice a month)	Weight-for-age, Length- for-age, Weight-for-length	After 3 months of intervention children in INE and INE+SF group showed recovery (37 and 47%) from moderate to mild or normal nutrition than control group (18%). This recovery rate was carried upto 6 months as nutritional status of intervention group improved 59 and 86% than control group (30%). Ability of mothers to identify malnutrition also improved from 15-99% in INE group and from 15-100% in the INE+SF group as compared to control group. Combine approach of nutrition education and supplementation is a effective approach as more children improved from moderate malnutrition to mild or normal nutritional status. Study concluded that nutrition education improves the nutritional status of moderately malnourished children with or without intervention

CONCLUSION

- It can be concluded that only nutrition education definitely improves the knowledge and practices of mothers and help in the recovery of moderately malnourished children by improving WHZ score
- Treatment of MAM children with only supplementary food had positive impact on recovery of MAM children. All kinds of supplementary foods studied, have shown gain in weight thus helped in recovery from MAM. Lipid based RUTF/RUSF had better recovery rate than locally produced CSB, CSB bases pre mix, locally produced mixes of various flours, locally processed fortified flour and milled flour. Plumpy'Sup also had shown good recovery
- Daily feeding had shown better recovery than weekly supplementation
- When treatment of MAM with INE and nutrition supplementation was done highest impact in recovery of MAM was seen among all the approaches
- Majority of the study focused only on weight gain, very few of them talked about gain in height, stunting, improvement in MUAC and none of them focused on improvement in iron status, cognitive development which is also important concerns for the malnourished child. There is need for more work on improvement in height and MUAC, cognitive development, effect of micro nutrient on MAM children

SIGNIFICANCE STATEMENT

Majority of the study conducted on effect of supplementation on nutritional status of moderate acute malnourished children but very few of them conducted research on effect of counselling with supplementation on nutritional status of moderate acute malnourished children and the results of these studies shows that this approach is better than only supplementation approach. Present review article point out this lacuna. So that more research can be conducted on the integrated approach of supplementation with counselling to improve the nutritional status of moderate acute malnourished children.

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