

WHO Technical Background Paper

Dietary counselling in the management of moderately malnourished children

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Abstract

Background. *Dietary counselling is an integral part of treating malnutrition. A first step towards improving the management of moderate malnutrition is to evaluate dietary messages in current programmes and assess their adequacy and effectiveness.*

Objectives. *To ascertain current recommendations regarding family foods for the treatment of moderate malnutrition and assess if these are likely to meet nutritional requirements for rehabilitation; to review the effectiveness of dietary counselling in the management of moderate malnutrition.*

Methods. *Information was requested from ten UN agencies/donors, twenty international non-government organizations, three paediatric associations and six national programmes about the dietary advice they give to caregivers of moderately malnourished children. Adequacy was assessed by comparing dietary recommendations with nutritional requirements. Linear programming was used to identify problem nutrients. A literature search was conducted of studies using family foods for rehabilitating malnourished children.*

Results. *There was a greater emphasis on providing food supplements for rehabilitation than on utilising family foods. Dietary recommendations were mostly vague and unlikely to be effective. Those developed by the World Health Organization and the Food and Agriculture Organization for well-nourished children may meet nutritional requirements in moderate malnutrition if the recommendations are made more prescriptive. Zinc and vitamin E emerged as possible problem nutrients. Intervention studies in wasted children suggest that counselling caregivers about family foods can achieve good rates of weight gain.*

Conclusions. *Dietary counselling can be effective in managing malnutrition, but it is often weak or absent and should be strengthened. More attention will need to be given to formulating the messages and improving counselling skills.*

Keywords: moderate malnutrition, rehabilitation, dietary counselling, dietary management, domiciliary care, family foods, effectiveness of treatment

Introduction

Background

Moderate malnutrition is common among children in poor countries and a significant proportion of affected children deteriorate and die if they are left untreated. For example, in a Filipino birth cohort of ~3000 infants who were weighed every two months until two years of age, on average 11% of those moderately underweight (-2 to -3 z-score weight-for-age) at any measurement deteriorated to severely underweight within 2 months, and of those who were moderately underweight at 6 months of age and subsequently died, 68% became severely underweight before death [1].

Malnutrition impairs immune function and malnourished children are prone to frequent infections which are more severe and longer lasting than in well-nourished children and may lead to a spiral

of ever-worsening nutritional status. In children who are moderately underweight according to the National Center for Health Statistics (NCHS) reference, the risk of death from diarrhoea is 5.4 times higher than in well-nourished children, and for death from pneumonia, malaria and measles the increased risk if moderately underweight is 4.0, 4.5 and 3.0 respectively [2]. The risk is attenuated when using World Health Organization (WHO) growth standards as a smaller weight deficit is required for children to be classed as moderately underweight [3]. It is estimated that 61% of diarrhoeal deaths, 57% of malaria deaths and 52% of pneumonia deaths in young children are attributable to coexisting underweight [2].

Despite an obvious need for action, moderate malnutrition has not received the attention it deserves and is rarely seen as a public health priority. The main questions to be addressed in this document are:-

- what dietary recommendations regarding family foods are currently given to mothers of moderately wasted or moderately stunted children by UN agencies, international non-government organizations (NGOs), paediatric associations or others?
- are current recommendations regarding family foods likely to meet nutritional requirements for rehabilitation?
- what is the effectiveness of dietary counselling in the management of moderate malnutrition?

Other aspects examined include message design and identification of problem nutrients. The focus is on treatment using family foods. Supplementary foods, manufactured therapeutic foods, and micronutrient powders and pastes are outside the remit of this review and are the subject of a separate paper prepared for this Consultation [4].

Context and definitions

The context and definitions were set for the Consultation by WHO. The context includes both food-secure and food-insecure situations in poor countries. Children below 5 years of age are the target group.

Moderate malnutrition includes all children with *moderate wasting* defined as a weight-for-height between -3 and -2 z-scores of the WHO child growth standard and all those with *moderate stunting* defined by a height-for-age between -3 and -2 z-scores of the WHO child growth standard. Most of these children will be *moderately underweight* (weight-for-age between -3 and -2 z-scores).

Methods

Current dietary recommendations regarding family foods for the management of moderate malnutrition were ascertained through correspondence with selected UN and donor agencies, international NGOs, Paediatric Associations, and Ministries of Health. A request for information was also posted at ProNut-HIV@healthnet.org, which is a global health information network. In addition, the WHO Secretariat made a request to 210 contacts.

Where sufficient data were available, dietary recommendations were compared with nutritional requirements derived for this Consultation for children with moderate malnutrition gaining weight at a rate of 5g/kg/day [5]. Linear programming [6,7] was used to identify 'problem nutrients' for a range of dietary patterns and to determine which combination of foods provided the 'best fit solution' in terms of meeting nutritional requirements. A hypothetical child aged 12-15 months, length 70cm, and weight 6.7kg was used to represent a typical case with moderate malnutrition (moderate stunting and moderate wasting).

To ascertain the effectiveness of dietary counselling a combination of database searches and hand-searching was used for studies published since 1980. These included Medline, Popline, PubMed, BIDS (CAB Abstracts) and the Cochrane Library. Personal contacts were also made for unpublished data. Any strategy for the dietary management of moderate malnutrition should:-

- have low case-fatality
- support catch-up growth and improve immune function
- provide continuing care and support, assess progress, and take action when needed.

To assess effectiveness of dietary counselling, information was therefore particularly sought regarding mortality, rates of weight and length gain, morbidity, immune function and post-recovery relapse rates.

Results

Current dietary recommendations

Letters were sent to ten UN agencies and donors, twenty international NGOs, three prominent paediatric associations and six large national programmes requesting information about the dietary advice they give to mothers and caregivers of moderately malnourished children. One follow-up letter was sent in the event of non-response. The respective response rates were 100%, 85%, 100%, and 100%. Up to four programmes were sought from agencies and NGOs working in multiple countries with the aim of capturing the widest range of programmes for moderately malnourished children. Respondents were asked to describe their dietary messages and target intakes for energy, protein and micronutrients as specifically as possible, and to describe how the advice is communicated and by whom, and if the child's progress is evaluated. Forty-three completed questionnaires were received and the responses are summarised in **Table 1**.

Only one programme (Bolivia) reported advising a specific treatment (zinc) for stunted, non-wasted children. One programme (Niger) reported recommending micronutrient supplements (iron, zinc, vitamins A and C) for stunted, mildly wasted children. In programmes where weight-for-age was used to identify low-weight children, as in growth monitoring and promotion activities, no further screening was usually carried out to differentiate children who were wasted from those who were stunted. Programmes using weight-for-age include the Bangladesh National Nutrition Programme (BNNP), the family health programme in Brazil (*Programa Saúde da*

Família), CARE, the Dream HIV/AIDS programme, the Integrated Child Development Services (ICDS) in India, the Integrated Management of Neonatal and Childhood Illnesses (IMNCI) in India, the Integrated Management of Childhood Illness (IMCI) of WHO, and the Trials of Improved Practices (TIP) of the Food and Agriculture Organization (FAO). In contrast, most NGOs reported specifically selecting wasted children for inclusion into their programmes, mostly on the basis of 70-79% of the median value of the NCHS weight-for-height reference or mid-upper arm circumference (MUAC) of 110-125mm [Table 1].

Paediatric Associations (International Paediatric Association, Indian Academy of Paediatrics, Royal College of Paediatrics and Child Health), and some donor agencies (World Bank, US Agency for International Development, UK Department for International Development, Bangladesh Rural Advancement Committee) reported that they do not make dietary recommendations for moderate malnutrition.

About half the respondents reported providing advice about family foods for young child feeding in the general context of health and nutrition education, but few reported emphasising family foods in rehabilitating malnourished children. Where education sessions were held, the information conveyed was on general issues aimed at preventing malnutrition in siblings or preventing relapse, with a focus on exclusive breastfeeding for 6 months, complementary feeding, hygiene, immunization, bed-nets and child care. Thus the same messages are being given to families regardless of whether their children are well-nourished or malnourished, and the dietary needs of malnourished children are thus not addressed.

Respondents working with populations suffering conflict, displacement, and/or food shortage, including the Office of the UN High Commissioner for Refugees (UNHCR), UN Children's Fund (UNICEF), World Food Programme (WFP) and most NGOs, reported informing mothers and caregivers about the use, preparation and storage of corn-soy blend (CSB) or other supplementary foods. In some programmes substantial efforts were reported, including cooking demonstrations, to ensure the safe, correct use of supplementary foods, but mostly there was little emphasis on family foods. This is unsurprising as these agencies work in food-insecure areas where family foods are scarce or non-existent. Some NGOs reported identifying locally available animal products and different coloured fruits and vegetables to enrich CSB-based porridge to improve dietary diversity and quality. Enrichment was often not possible, however, as high prices and exhausted household assets limited families' ability to purchase or barter.

Médecins sans Frontières (MSF) reported providing ready-to-use therapeutic food (RUTF) for treatment of children with moderate malnutrition, and GOAL reported distributing RUTF for moderately malnourished children with medical complications. Some UNHCR and UNICEF programmes reported providing RUTF for moderately malnourished children with HIV.

WHO advocates food supplements for moderately wasted children only in emergency situations [8]. Respondents reporting on activities of Africare, IMCI, INMCI (India), FAO, Food for the Hungry, Improving Livelihoods through Increased Food Security (I-Life) (Malawi) and Terre des Hommes stated that no supplementary food was provided in their programmes for treatment of moderate malnutrition and that their focus was on family foods. Their approaches are described later.

Overall, recommendations regarding family foods tended to be broad and imprecise. Three food groups (for energy, growth, and protection) with illustrative posters were reported by several respondents as the central focus for their teaching. Individual dietary counselling was rare and

only three respondents (IMNCI-India, FAO, and WHO) reported recommending specific quantities of foods. Portion sizes for specific nutrient-rich foods were absent in all reports except FAO. One respondent with wide experience reported that *'the education component in most programs is weak. From my experience to date, what I've observed is that the traditional preach and expect people to practise does not work. The only real successeshave been through practical demonstrations followed by supervised practice sessions... reinforced..... through ongoing support until it is adopted into routine household activities'*

Dietary messages were communicated by a variety of cadres ranging from volunteers to nurses and nutritionists, and posters were the most frequently mentioned teaching aid. Whilst most respondents said they monitored children's weight, fewer than half reported having a target rate of weight gain during rehabilitation. Where reported, the target was typically >2.5 or $>3\text{g/kg/day}$, which is modest.

Programmes providing dietary counselling, no supplementary foods

In this section additional information is provided about the programmes of UN agencies, NGOs and others that rely on family foods alone to meet the nutritional needs of malnourished children, and the extent to which these programmes provide specific dietary recommendations. The findings show differences in approach and in the specificity of the advice. For example the approach used by WHO relies on individual counselling of mothers and caregivers whereas NGOs reported disseminating advice through group activities, for example using the Positive Deviance/Hearth model.

IMCI and INMCI

IMCI was developed in 1992 by WHO and UNICEF with the aim of reducing deaths from diarrhoea, pneumonia, malaria, measles and malnutrition, through prevention or early detection and treatment. IMCI is the conduit through which all community health interventions can be delivered to the child. UNICEF works closely with WHO and partners in implementing IMCI, and especially its community component (C-IMCI). In 2000, the Government of India, in their national adaptation of the IMCI strategy, gave greater attention to neonatal care and named their programme IMNCI. Other countries have followed India's lead.

The IMCI/IMNCI algorithm [9] does not specifically identify moderate underweight: it only defines severe cases (<-3 z-score weight-for-age). Feeding practices are assessed routinely for all children, focusing on the number of breastfeeds/day, other foods given, meal frequency and how given. For low-weight children, additional questions refer to serving size, who feeds, and whether the child has his own plate. If the child is not being fed according to the feeding recommendations (i.e. breast fed on demand, given appropriate foods, adequate servings 4-5 times/day, responsive feeding) then mothers are counselled. If there is a feeding problem, the child is seen again in 5 days. The dietary recommendations are essentially the same for moderately malnourished and well-nourished children.

The WHO training course on Infant and Young Child Feeding Counselling provides more specific orientation about 'appropriate' foods and 'adequate' quantities [10]. The three key messages about 'which foods' are that mothers should give animal-source foods daily, a dairy product daily, and a dark-green or yellow vegetable or yellow fruit daily. If meat is not eaten, pulses, nuts or seeds are to be substituted and eaten with an iron enhancer such as food rich in vitamin C. The recommendations for quantities of food to give are: child 6 – 8 months gradually

increase to approximately ½ cup at each meal; child 9 – 11 months: approx. ½ cup at each meal; child 12 – 23 months: approx. ¾ to 1 cup at each meal.

WHO child growth programme

The WHO training course on child growth assessment, which is linked to implementing the new growth standards, provides a job aid for investigating causes of undernutrition and recommends actions to discuss with a child's mother to address the causes [11]. This job aid is used when a child is moderately wasted, or moderately stunted, or moderately underweight. The line of questioning is similar to that followed for IMCI, but in rather more detail, encompassing feeding practices and the child's health and environment (steps 1-6). Preparation for counselling (steps 7-8) includes setting goals for 2-3 actions that a mother can take. Most advice for moderate malnutrition relies on the generic recommendations for well-nourished children. The recommended foods (eight categories) are staple foods, animal-source foods, milk products, green leafy and yellow-coloured vegetables, fruits, pulses, oils and fats, and groundnut and other nut/seed pastes. Serving sizes (cups/meal) and the number of meals and snacks are specified for two age groups (6-12 months and 1-2 years), and energy density is taken into account when determining meal frequency. For example, for children aged 1-2 years, the recommendation is for 3-4 meals daily with a serving size of ¾ cup at an energy density of 0.8-1.0kcal/g, and 1-2 snacks between meals. Serving sizes are increased to 1 cup for lower energy densities. For stunted children, the addition of legumes and animal-source foods to meals is encouraged to improve nutrient quality. Actively helping and encouraging the child at mealtimes are also emphasised. For HIV-exposed children, additional animal-source foods and fruit or vegetables twice/day are recommended.

FAO

In Zambia and Afghanistan, the Nutrition Education Group of FAO has been using the Trials of Improved Practices formative research methodology [12] to tailor complementary foods and feeding recommendations to the needs of children aged 6-24 months and address moderate malnutrition (E Muehlhoff, personal communication). The focus is on locally available foods and two booklets have been developed [13,14] which are used in conjunction with growth promotion counselling cards. The booklets are for community nutrition promoters, peer educators, and development workers. The format broadly follows the WHO booklet 'Complementary feeding: family foods for breastfed children' [15]. For example, dietary recommendations for Zambia include eating the staple with a relish containing at least three ingredients from a list of six (fish; beans; green leaves; pounded groundnuts; chicken, eggs or meat; oil), and eating at least three different kinds of fruit and/or vegetables daily. Portion sizes recommended for the relish, fruit, and vegetable are the amount that can fit into a child's hand. The total meal size recommended is ½-¾ cup for children aged 6-8 months, ¾-1 cup at 9-12 months and 1-1¼ cups at 12-24 months. Adding a small spoonful of red palm oil to all vegetable relishes is also recommended.

Africare and I-Life

These NGOs reported using the Positive Deviance (PD)/Hearth approach to promote recovery of moderately malnourished children. In this approach, Positive Deviance Inquiry is used to identify feeding, care-giving and health-seeking behaviours practised by mothers and caretakers of well-nourished children from poor families and to transfer these positive practices to those in the community with malnourished children [16-18]. The originators were Gretchen and Warren Berggren at the Hôpital Albert Schweitzer, Haiti [19]. PD/Hearth focuses on maximizing existing resources and utilizing local skills and knowledge. Community volunteers help caregivers practise new cooking, feeding, hygiene or other target behaviours for approximately 2 hours daily during 12 days. Caregivers bring a daily contribution of food and/or cooking materials and

practise in groups of about ten in a local home. The volunteers continue to keep in contact with participants through home visits for two further weeks. PD/Hearth programmes often operate in conjunction with growth monitoring, which is used to identify both the malnourished children and positive-deviant families. ‘Learning by doing’ builds caregiver confidence and self-efficacy, and the visible changes in the children’s nutritional status are reported to provide motivation for sustained behaviour change [17]. PD/Hearth is implemented mostly by NGOs, and Save the Children (US) was one of the first to use this approach for the rehabilitation of malnourished children, starting in 1990 [20]. PD/Hearth is considered to complement Ministry of Health Essential Nutrition Services, which are largely facility-managed [21] and PD/Hearth is complementing community-based therapeutic care activities in a pilot project in Niger. In this World Vision project, moderately underweight children aged 6-36m who do not qualify for supplementary feeding (i.e. mainly stunted children) are enrolled in a Hearth programme where mothers are encouraged to use Moringa leaves and peanut flour to enrich children’s meals (S-S Dimanche, personal communication).

Africare has implemented PD/Hearth in eight African countries as part of USAID Title II food security initiatives. These are Burkina Faso, Guinea, Mali, Niger, Sierra Leone, Rwanda, Malawi and Mozambique. In Guinea, Hearth sessions are led by an exemplary mother chosen by a volunteer community health agent trained by *Africare*. This model mother then acts as a peer educator whose role includes disseminating messages (usually one theme for each of the 12 sessions), giving demonstrations, and participating in follow-up growth monitoring [22]. She is assisted by volunteer community health agents and *Africare* field staff. Micronutrient-rich foods are highlighted. Other activities take place in tandem, such as improved agriculture, income generation, water and sanitation. Qualitative research indicates that Hearth mothers in Guinea have increased awareness about malnutrition and its link with illness and have improved home hygiene and dietary diversity. Hearth children were reported to have improved appetite and weight gain, and to be more joyful and lively [22]. Six months after the Hearth sessions, the proportion who were well-nourished rose from 0% to 44%.

I-LIFE is a consortium of seven NGOs (*Africare*, Catholic Relief Services, CARE, Emmanuel International, Save the Children, Salvation Army, World Vision) working in seven districts of Malawi, and receives USAID Title II funding. The programme reaches over 60,000 households and uses the PD/Hearth approach for rehabilitating mild and moderate malnutrition (A. Kebede, personal communication). Mothers and caregivers are encouraged to prepare an energy-dense, nutrient-enriched maize or sweet potato porridge, for example adding groundnut flour and pumpkin leaves, or milk/egg and oil, or soya flour and to give this with fruit in addition to the usual diet. Mothers and caregivers attend daily in small groups for 12 days at a local house or meeting place where they prepare the enriched porridge. They arrange to bring seasonal ingredients with them for the porridge, with guidance from project staff, and are encouraged to prepare the same porridge at home. The aim is to provide a meal of 600-900 kcal, rich in protein and vitamin A.

I-LIFE also promotes irrigation projects and kitchen and communal gardens, with an emphasis on the cultivation, processing and preservation of high-nutrient indigenous crops through 6000 Care Groups. The Hearth model fits well within the framework of Care Groups, which aim to help programmes go to scale. Care Groups use paid promoters. Households with children under-five are identified by census and grouped in blocks of 10-15. One volunteer is selected from each block and is responsible for 10-15 households. Volunteers are grouped to form a Care Group who meet every 2-4 weeks and the promoter trains the volunteers about the messages to be communicated to households [23]. Thus one promoter trains and supervises 10-15 volunteers

who in turn are responsible for 10-15 households. The concept was pioneered by World Relief in Mozambique and similar programmes have been implemented by Food for the Hungry.

Terre des Hommes reported that their staff in West Africa train community volunteers to demonstrate how to enrich porridges with fish powder, legumes, groundnut paste, green leaves, eggs, oil. High rates of recovery (>90%) of moderately wasted children in Benin are reported, with an average time of 4 weeks to attain a well-nourished state (J-P Papart, personal communication). Volunteers apply the principles of community-IMCI, including prevention and early treatment of infections.

Extent to which dietary recommendations have been evaluated

In the questionnaire, respondents were asked whether the effectiveness of the dietary counselling component of their programme had been evaluated. Most respondents reported having no evaluations, but since few gave prominence to family foods in rehabilitation this lack is not surprising. Both I-LIFE and Food for the Hungry provided data showing many children moving into the normal range with PD/Hearth or Care Groups. Terre des Hommes reported an average rate of weight gain of ~2g/kg/day for moderately wasted children supervised monthly in Senegal and 4-5g/kg/day with weekly supervision in Benin.

Summary of current dietary recommendations

The dietary recommendations reported by respondents as being given to mothers of moderately wasted or moderately stunted children reflect, at best, the guiding principles for feeding young children, and are not necessarily aimed at rehabilitation. For the most part the recommendations are non-specific and this may limit their effectiveness in achieving catch-up growth. There seems, however, to be a general awareness of the need to provide energy-dense, micronutrient-rich foods. The most explicit recommendations among respondents are those developed by FAO in collaboration with the Governments of Zambia and Afghanistan, and their recommendations are distinctive in that the portion sizes of micronutrient-rich foods are defined (the amount that fits a child's hand). No evaluation of the effectiveness of their recommendations in achieving catch-up growth has been undertaken. Apart from two exceptions, the dietary recommendations given for stunted children do not differ from those for wasted children.

Adequacy of current dietary recommendations

The terms of reference envisage that it would be possible to use the information provided by agencies and NGOs to determine the nutritional adequacy of their dietary recommendations for catch-up growth and identify problem nutrients. This is a difficult task, if not impossible, when recommendations are non-specific. For example, enriching porridge is commendable but unless one also knows meal frequency, amounts fed, and if porridge is the sole food, then it is difficult to assess dietary adequacy. It was clear, however, that some of the nutritional contents reported for enriched porridges were incorrect. This may be due to faulty or incorrect use of Food Composition Tables or mathematical error. Reported recommendations also included foods of low micronutrient density e.g. grape, apple.

One commonly used approach for assessing adequacy is to compare a day's menu with nutritional requirements. This can be done with Food Composition Tables and a hand calculator. As a working example, a menu from Bangladesh was slightly adapted to match the WHO recommendation to eat an animal-source food (in this example egg was chosen), a milk product

(milk), green leafy and yellow-coloured vegetables (spinach, pumpkin), fruit (pawpaw, guava), pulses (lentils), oils and fats (vegetable oil) [11]. With this menu, and assuming a non-breastfed, moderately malnourished child aged 12-15m weighing 6.7kg, the intake of six nutrients is below the proposed requirement (zinc 41% of that required; calcium 44%; vitamin E 61%; vitamin A 75%; thiamine 87%; iron 87%). Annex 1 shows the foods, amounts and nutrient intakes. There would be no deficit in vitamin A and iron if the menu included 10g of chicken liver, illustrating that a) even when one adheres to reasonably tight recommendations, diets can differ in adequacy and b) some diets do not meet requirements even when they conform to WHO recommendations. This can be due to which foods are selected from a list, and amounts eaten.

One solution to this problem is to be very prescriptive and this has been the approach used by some when rehabilitating severely malnourished children at home with family foods [24-27]. For example, Ahmed and colleagues recommended khichuri and halwa as 'special foods', and achieved a mean rate of weight gain of 10.4g/kg/day [27]. Zinc, iron and multivitamins were provided to support rapid weight gain. The evidence, albeit limited, suggests that mothers are willing to prepare prescribed diets, at least for a limited time, and that children are willing to eat them.

As noted above, even one small manipulation of a menu can improve the adequacy of a diet and, after several iterations, one can design a set of meals that best meet the requirements. This time-consuming task can be eased by linear programming [6,7]. This technique also allows flexibility: for example it allows foods to be limited to one or two servings per week, which may be more realistic.

Problem nutrients

Using data from Bangladesh by means of illustration, the optimum combination of foods to meet the requirements of a moderately malnourished child was identified by linear programming. The procedure is comparable to phase 1 of the four-phase goal programming model described by Ferguson et al. [7] and we have used the food list and portion sizes of Dewey et al. for young children in Bangladesh [6]. Energy and nutrient intakes were calculated primarily from Food Composition Tables of the World Food Dietary Assessment System [28]. The energy requirement was set at 770kcal/day (115kcal/kg/d, child's weight 6.7kg), and the child's nutrient requirements were deduced from the proposed nutrient requirements/1000kcal [5]. All nutrients were considered equally important apart from sodium, where no attempt was made to meet this requirement as the food composition table values were for foods cooked without salt, and are thus likely to be underestimates. Selenium, iodine, biotin, vitamin K, vitamin D and essential fatty acids were omitted from the model because food composition tables were incomplete for these nutrients and/or unreliable as composition may vary with the soil content.

Table 2, column 1 shows the foods that were selected for inclusion, and we considered that all foods could be eaten daily except chicken liver, for which an upper limit was set at twice per week. We considered that rice would be eaten every day and so we forced rice into the model. We considered that if lentils were selected they would be eaten with rice in a ratio of 1:1.5, and this linkage was built into the model. Column 2 shows the amounts that were considered as the maximum that a child aged 12-15 months could eat during a day [6]. The remaining columns show the best-fit solutions derived by linear programming for six dietary patterns, ranging from omnivore to an increasingly vegetarian pattern. The amounts represent the average over 7 days, and not all foods are expected to be eaten every day. So for example 60g of a food eaten on 2 days would appear as an average of 17g/d. Only one of these patterns (Pattern 1) is for a breastfed

child and we assumed a breastmilk intake equivalent to that of an average healthy child aged 12-24 months [29].

Table 3 shows the extent to which the requirements were met, and the problem nutrients (i.e. those where <95% of needs were met).

- a) Pattern 1: breastmilk (530ml) was forced into this model. ‘Open choice’ of foods. The problem nutrients were vitamin E, calcium, iron and zinc.
- b) Pattern 2: the child was assumed to be non-breastfed. ‘Open choice’ of foods. The problem nutrients were vitamin E and zinc.
- c) Pattern 3: liver was excluded as an option from Pattern 2. The problem nutrients were vitamin E and zinc.
- d) Pattern 4: liver, chicken and fish were excluded from Pattern 2. The problem nutrients were vitamin E and zinc.
- e) Pattern 5: liver, chicken, fish, and eggs were excluded from Pattern 2. The problem nutrients were vitamin E and zinc.

Pattern 5 was then re-run but using lower estimates for the requirements of vitamin E and zinc. For vitamin E we used the age-specific requirement (7.6mg/1000kcal instead of 11.5mg/1000kcal) and for zinc we took the figure that assumes no tissue deficit (5.4mg/1000kcal instead of 13mg/1000kcal). When these lower estimates were used, vitamin E and zinc were no longer problem nutrients but iron had 86% adequacy (Pattern 6) as there was a trade-off between meeting the requirements for vitamin E and those for iron. There were no problem nutrients in Pattern 7 when one animal food (liver, chicken, fish or egg) was allowed daily.

It may seem surprising that Pattern 5 with no liver, chicken, fish or eggs was no more problematic in meeting requirements than when these foods were included (Patterns 2-4), but even with an ‘open choice’, as in Pattern 2, linear programming chose substantial amounts of milk, lentils, pumpkin, spinach, pawpaw and guava, all of which featured in Pattern 5. Of note is that three of these foods (pumpkin, spinach, guava) were at the amounts considered as the maximum that a child of this age would eat. Interestingly, the food combinations generated by linear programming are very similar to those successfully used in Bangladesh by Khanum et al. and Ahmed et al. for rehabilitating severely malnourished children [24-27].

When Pattern 7 was re-run excluding mango, orange and pawpaw to simulate seasonal shortage, different quantities of foods were selected in the ‘best-fit’ solution, but overall adequacy was maintained (data not shown).

When the analyses were re-run using foods and amounts from the Ghana database [6] the findings were similar, despite using very different staples and other foods.

Refining dietary recommendations

Can these best-fit solutions help us refine dietary recommendations to meet the needs of moderately malnourished children? As indicated earlier, adequacy varies according to which foods are chosen from lists of recommended foods. It is thus important to know if the recommendations are adequate for a ‘worst case’ scenario, e.g. if a mother chooses cabbage rather than spinach, or cassava rather than rice. Testing ‘worst-case’ scenarios can be helpful in refining lists of recommended foods so that requirements are met for all scenarios. More prescriptive dietary recommendations usually emerge from such testing. ‘Best-fit’ solutions must also be able to be assembled into recognizable meals, so considerable care is needed when using this methodology. Best-fit solutions must also be tested for different age groups. Dietary

recommendations must be affordable, sustainable, culturally appropriate and simple to convey to mothers and caregivers, thus it is important to test the suitability of 'best-fit' solutions through household trials of behaviour change, and to modify the recommendations if needed. In some situations, one may need to consider whether costs can be reduced by providing part of the micronutrient requirements as a supplement.

The results presented above are intended as examples of linear programming and cannot be extrapolated. In all settings, nutritional adequacy should be checked. In some settings sufficient information may be available to make linear programming possible, and in these cases linear programming can help optimise the use of local foods in meeting nutritional requirements.

Effectiveness of dietary counselling in the management of moderate malnutrition

Studies were sought in which mothers or caregivers of moderately malnourished children were counselled about rehabilitating their children at home with family foods. Only two studies were located in which moderately malnourished children were specifically targeted: both of these were in Bangladesh [30,31]. Studies were therefore also sought in which severely malnourished children were rehabilitated at home with family foods until reaching at least 80% weight-for-height or -2 z-score. The justification for their inclusion is that these children pass through a phase of moderate malnutrition during their recovery.

Ten studies were examined and **Table 4** summarises the data [20,24-27,32-38]. Where possible, the Table identifies nutritional status of the children at recruitment, the type of intervention and the implementer, and the outcomes (case-fatality, weight gain, morbidity, progress during follow-up, and relapse). Immune function was not an outcome in any of the studies. Only sketchy information is provided about the intervention and its delivery for several studies, and some lack methodological rigour. Few authors report rates of weight gain so where possible estimates were made from other data presented, but with consequent risk of error. Sample sizes are small in some studies.

The studies indicate varying success, with average weight gains ranging from around 1.5 - 10g/kg/day. Those with slow rates of weight gain appear to have a high proportion of stunted subjects, for whom rapid rates of weight gain would not be expected. Five studies report morbidity, which was high in four of these.

Two studies [32,33] provide little information about the dietary counselling, and eight, which describe delivery of the intervention and report the findings in some detail, are described below.

South African study of Glatthaar et al. [34] The subjects were hospital outpatients with moderate underweight, mean age 18 months, many from urban squatter settlements north of Pretoria, who were rehabilitated at home through dietary counselling. Their illnesses were treated and they were randomised to dietary intervention or control groups. Dietary modifications that were promoted were increased feed frequency (5-6 meals and snacks), increased energy density of porridge (by making it thicker and adding fat, oil or sugar), addition of protein-rich foods (e.g. milk to porridge, and legumes, peanut butter, chicken, offal or eggs to the staple) and increased consumption of vegetables. Nurses fluent in local languages delivered the counselling at six home visits, which included demonstrations and supervised practice. The aim was an intake of 120kcal/kg/day and 3-4g protein/kg/day with an emphasis on 'practical measures, rather than abstract concepts'. The first visit lasted 1.75 hours on average, and subsequent visits lasted 30

minutes, with intervals of about 2 weeks between visits. The intervened children (n=65) moved from 81% to 88% weight-for-length during 3 months, with a rate of weight gain (estimated) of about 1.6g/kg/day, but the control children (n=75) also improved to a similar extent. Thus the dietary counselling *per se* did not have a significant role in the children's recovery, and the authors suggest that the initial treatment of infections may, at least in part, have played an important role. A high incidence of diarrhoea in the study population during the rehabilitation period may have limited the rate of catch-up growth.

Peru study of Fernandez-Concha et al. [35] The subjects resided in a peri-urban shanty town of Lima and most of the 54 subjects were moderately underweight. Dietary counselling was provided by a physician, first at home and then at a clinic. A nurse also helped with counselling at the clinic. Mothers received seven basic messages about breastfeeding, good complementary feeding, meal frequency, handwashing, birth spacing and prenatal nutrition. After 3 months, approximately 50% of the children had moved into the mild/well-nourished category.

Jamaica study of Bredow et al. [36] In this study highly prescriptive dietary advice was provided by health aides to mothers of malnourished children at a clinic. The advice for catch-up growth was to prepare a high-energy milk (150kcal/kg/day), which could be taken as a drink or made into porridge. Other family foods were allowed but only in addition to the milk. The milk was prepared from skimmed milk powder to which was added margarine or coconut oil. The amounts of milk powder and margarine (in soup-spoonsful) were calculated for each child according to weight and mothers were given explicit instructions. Malnourished children (n=25, Gomez grade I and II) with a mean weight-for-age of 68% improved to 77% over 5.6 months, equivalent to a weight gain (estimate) of 1.4g/kg/day. Most were moderately stunted and mildly wasted.

Bangladesh study of Khanum et al. [24-26] This study was implemented by the Children's Nutrition Unit, Dhaka, which served as a referral centre for severe malnutrition with ~1300 admissions/year. It was largely financed by Save the Children, UK. Admission criteria were weight-for-height <60% and/or oedema. In 1990, treatment at home with family foods was introduced and a cost-effectiveness trial was undertaken to compare i) inpatient care (n=173) ii) day-care (n=134), and iii) domiciliary care after one week of day-care (n=130). In the domiciliary group, home visits were weekly for one month or until oedema disappeared, and then fortnightly. Multivitamins and iron were provided for the domiciliary group, but no food. None of the groups received zinc. Whilst at the Unit, caregivers received 20 minutes structured instruction each day on topics relevant to child feeding, disease prevention and family planning. They also participated in cooking demonstrations and practised meal preparation. The domiciliary group received additional instruction during their week at the Unit, particularly what to feed, how much, and how often. The foods recommended for daily consumption at home were one bowl of rice pudding, one bowl of rice-lentil-vegetables, one bowl of rice-lentil/potato-pumpkin with meat or fish if affordable and cooked in oil, 3 cups of milk, and two snacks (chapatti, dhal, banana or fruit). The bowl (340g capacity) and cup (180ml) used in the practice sessions were given for the child to take home. Marks were put on the containers to indicate the amount to give, according to the child's weight.

The domiciliary group gained weight more slowly than the other two groups but was about one-fifth of the cost of in-patient care. The rate of weight gain during the period approximating 'moderate malnutrition' averaged 4-5g/kg/day. Children gained in stature, but not height-for-age. Infections were reported in 38% of study weeks, and infection, poor appetite and non-adherence to dietary advice adversely affected weight gain at home. Financial constraint was the main reason for not adhering to the feeding advice. The authors concluded that better weight gains and

improved resistance to infection might have been achieved if the domiciliary group had continued to receive potassium and magnesium, and if all children had been given zinc.

The home visitors were very motivated and carefully selected and trained. They gave feasible advice, were sympathetic and supportive rather than castigating, and involved fathers and grandparents in decision-making. They were trained to weigh and examine children and differentiate minor from major illnesses so they could refer back when necessary.

Parents preferred domiciliary care despite their poverty and the substantially higher parental costs. Following the trial, domiciliary care became a routine service and parents were offered a choice of inpatient, day-care or domiciliary care. Mothers of recovered children also acted as informal peer counsellors to give help and encouragement to other mothers rehabilitating their children at home.

Bangladesh study of Ahmed et al. [27]. Severely malnourished children admitted to the Dhaka Hospital of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR) were randomised after 7 days to a) domiciliary rehabilitation with home visits by health workers b) domiciliary rehabilitation with clinic visits, or c) continued inpatient care. No deaths occurred in the domiciliary groups and the median time taken to reach 80% weight-for-height was 20 days with home visits, and 37 days and 17 days respectively for the clinic and inpatient groups. The rate of weight gain in the home-visited group averaged 10g/kg/day, compared with 7.5g/kg/day for clinic visits and 12g/kg/day for inpatients. Domiciliary care was about one-third the cost of inpatient care.

No food was distributed. Considerable effort was made to identify specific high-energy, high-protein, low-cost foods to promote for home-feeding. These were khichuri and halwa, and mothers practised preparing these foods before going home. Zinc syrup, folic acid, multivitamins and iron supplements were provided. The Dhaka Hospital has a well-established health and nutrition education programme for mothers, which includes many aspects of child care. (NB dispersible zinc acetate tablets 20 mgZn/day have now replaced zinc syrup).

This study shows that rapid rates of weight gain (10g/kg/day) can be achieved at home with family foods and a micronutrient supplement. The children moved from a mean of -3.2 to -1.9 weight-for-height z-scores in 20 days. Since 8 of these 20 days included the stabilisation period when no weight gain is expected, the actual rate of weight gain at home can be expected to have been higher than 10g/kg/day.

Viet Nam study of Schroeder et al. [20, 37-38] In the 1990s, Save the Children (US) developed a PD/Hearth component as part of an integrated nutrition programme in Viet Nam. Community health volunteers identified malnourished children (<-2 z-score weight-for-age) through regular screening and enrolled them in the programme, which also included deworming and supplementation with vitamin A and iron. Children who did not gain adequate weight during the 12-day Hearth sessions were invited to attend a second cycle. If they still did not gain sufficiently, the families were provided with revolving loans, for example laying hens [39]. These families were required to give their malnourished children at least five eggs each week. In the evaluation study, 6 communes were randomly selected to receive the programme and these were matched with 6 communes to serve as controls. In each group, 120 children were randomly selected from hamlets with the highest rates of malnutrition. Moderately underweight children were identified (n=35) and followed prospectively. There were 19 in the control area and 16 in the intervention area. Both groups deteriorated in height-for-age and weight-for-age following

recruitment, but the intervened group deteriorated significantly less, relative to controls. Despite a significant benefit of the Hearth programme, it cannot be considered successful as the children's nutritional status deteriorated. This may have been due to lack of catch-up in height, as the children were underweight primarily because they were stunted, and failure to catch-up in height would have a direct effect on weight-for-age.

The programme achieved integration of the volunteers' activities with primary health services and with vertical programmes (e.g. expanded immunization, acute respiratory infection and diarrhoeal disease control, family planning) [39].

Bangladesh studies of Roy et al. [30,31]. These two studies specifically recruited moderately underweight children (weight-for-age 61-75% NCHS reference).

In the first study [30], mothers of 282 children aged 6-24 months attending growth monitoring nutrition centres were randomised to one of three groups. One group received nutrition education twice weekly for 3 months and the second group received the same education intervention plus a wheat-pulse-molasses-oil food supplement of 300kcal and 8-9g protein/day. The comparison group received standard nutrition-centre services with no supplementary food. Graduate-level health assistants delivered the education intervention, which focused on the preparation of *khichuri* (rice, lentils, potato, green leaves, oil and egg/meat/fish). The preparation of *khichuri* was demonstrated and practised, and the nutritional content of food ingredients was described. Other family foods mixed with oil were also encouraged. Mothers were advised to cook the whole amount of *khichuri* (650g) in the morning and feed this in 5-6 servings during the day, and to give children their own bowl. The two intervention groups improved in weight-for-age compared with the comparison group ($p < 0.001$ in each case). There was no significant difference, however, between the two intervention groups, implying that the food supplement provided no added benefit. Children in the intervention groups had significantly more diarrhoea than comparison children, and diarrhoea had a negative effect on weight gain. Whether the diarrhoea could be due to prolonged storage of the *khichuri* is not discussed.

Although the effect of the intervention on weight-for-age was statistically significant, the rate of weight gain was slow (estimate 1-2g/kg/d) and only around 40% of the children moved into the mild/well-nourished category. Children, however, were stunted rather than wasted. Length gain was significantly greater for children receiving the food supplement (3.5cm vs 2.3cm unsupplemented) and their length-for-age improved. Unsupplemented children deteriorated in length-for-age (S.K. Roy, personal communication).

In the second study [31], an intensive education regimen (twice weekly for 6 months, $n=292$) was compared with a less frequent education regimen (once weekly for 3 months and then fortnightly for a further 3 months, $n=287$). Four *upazilas* were selected, and from each of these 30 nutrition centres were selected, which were randomised into two groups. Groups of 6-8 mothers were counselled by health assistants about child feeding, and they were encouraged to feed energy-dense, nutrient-dense foods. Oil, egg, vegetables and fruits were emphasised, as was the need for the child to have his/her own bowl. The preparation of *khichuri* was demonstrated and practised, and the nutritional content of food ingredients was described. Both groups gained 1.3kg during 6 months' intervention, giving a rate of weight-gain of 1g/kg/day. Approximately 40% of children moved into the mild/well-nourished category by the end of 6 months. Again the children were stunted rather than wasted, and they deteriorated in length-for-age during the 6-months' intervention.

Neither of these studies can be considered a success in terms of catch-up growth. Behaviour change was reported in both studies, but this was insufficient to achieve catch-up in length.

Conclusions regarding the effectiveness of dietary counselling

Published data regarding the effectiveness of dietary counselling to mothers of moderately malnourished children are very limited. In the studies reviewed, rates of weight gain tended to be slow, with estimates of 1-2g/kg/day. Recurrent infections, associated with poor living conditions and high pathogen exposure, were reported in four of the five studies with morbidity data, and poor appetite during illness may have limited growth. Most of the data, however, pertain to stunted, rather than wasted children, and relatively slow rates of weight gain can be expected for stunted children. In Bangladesh, where the prevalence of low birth weight in poor families is very high, it is likely that many of the stunted children would have been growth retarded *in utero*.

For studies with predominantly wasted children, weight gain was more rapid and an average rate of 10g/kg/d was achieved with family foods and zinc/iron/multivitamin supplements in Bangladesh. Where zinc was not provided, the average rate of weight gain was more modest (4-5g/kg/day). Common elements included frequent meals (at least 5), food mixtures that families could afford, and opportunities to learn through supervised practice.

Discussion

Advocacy is important for action, but advocacy remains weak for improved complementary feeding and for utilising family foods for catch-up growth, especially when compared with advocacy for breastfeeding [40]. As one authoritative respondent reported '*We are facing a capacity crisis in nutrition as nutrition programmes are not given priority at policy and implementation level. There is negligible emphasis given to preventive programmes. Donors prefer quick fix solutions favouring micronutrient supplementation and ready-to-use foods, spreads and sprinkles ... instead of addressing the root causes of undernutrition*'.

It is widely accepted that the quality of nutrition counselling is often poor, whether it be in growth monitoring and promotion programmes, or for improving complementary feeding, or for community-based rehabilitation [41,42]. Evidence is accumulating, however, both from malnutrition rehabilitative and preventive programmes, that dietary counselling can be effective when done well and can achieve gains in length and weight [27, 43-46]. In successful programmes, frequent regular exposure to a few, simple, uniform age-appropriate messages has been found to be important, together with an opportunity for interaction between caregiver and counsellor. Achieving a balance between delivering uniform messages and negotiating compromises to fit, for example, competing demands on mothers' time, requires significant skill and insight, but nutrition counselling is often left to minimally trained personnel or volunteers, with poor knowledge and communication skills.

Over the years there has been a shift in emphasis in young child feeding from protein quantity and quality to energy density, and more recently to micronutrient density, and these shifts have been reflected in programmes, research agendas and donor funding. This shift in emphasis, however, should not be construed as meaning that the earlier foci of emphasis were misplaced, as all these aspects are relevant when considering rehabilitation of malnourished children. The importance of the home environment on growth has also been increasingly recognised, with attention being given to feeding frequency, active feeding, hygiene, and management of illness,

among others. These aspects, too, are relevant when considering rehabilitation of malnourished children, but with so many factors for consideration, it can be difficult to decide on a few priority messages.

Formative research is an integral part of the design and development of nutrition counselling interventions so that the social context and the resources available at home (food, fuel, time etc) are taken into account. The aim is to provide feasible, memorable messages that motivate behaviour change. Lack of formative research can lead to recommendations that are unrealistic or conflict with cultural beliefs. Even when efforts are made to take cultural beliefs into account when designing nutrition interventions, feeding messages can face resistance and be ignored because of other constraints, as was reported from China [47]. Non-adherence to counselling messages is commonly associated with lack of resources and incompatibility with demands on mothers' time, which may include time away from the home for paid employment or agricultural work. Peltó and colleagues [48] list four principles for formative research:-

- obtain knowledge about current feeding behaviours
- obtain an understanding about key context conditions and determinants of current behaviours
- work with communities to design interventions that are responsive to the context and local values
- build on the principles and strategies of individual, family and community behaviour change.

The feasibility of rehabilitating malnourished children with family foods depends on the social context and the family's access to food. It is clearly not feasible to rely on family foods in food-insecure humanitarian relief settings. Some contexts, however, have the potential to access family foods for example by establishing agricultural plots or kitchen gardens, but this potential may be suppressed by the provision of supplementary and therapeutic foods.

Ideally the health-system infrastructure should integrate both prevention and treatment of malnutrition, and it may be possible to take local or national complementary feeding guidelines (aimed at malnutrition prevention) and make minimal adjustments so that they support catch-up growth. The recommendations for a malnourished child may thus become somewhat more prescriptive than for a healthy child, such as give *two cups of milk* rather than 'a dairy product', or *half a cup of pawpaw* rather than 'an orange-coloured fruit'. Malnourished children rehabilitated at home need to be monitored, either through home visits or at a clinic. Clinics should play a key role in home rehabilitation as they are the most sustainable delivery channel. The IMCI strategy envisages them as pivotal in preventing malnutrition, case-finding, referral, and monitoring. With appropriate training and resources, clinic staff could deliver home-based rehabilitation. The NGO sector can also be pivotal in scaling up. For example, the Bangladesh Rural Advancement Committee (BRAC), which started in response to the plight of thousands of refugees after Bangladesh's War of Independence, is now a global leader in primary health care and social development, and reaches more than 110 million people in Asia and Africa. The joint UNICEF and ICDS *Dular* project in Bihar and Jharkhand, and the *Anchal Se Angan Tak* project in Rajasthan, also reach very large populations through village workers. One of the challenges in going to scale is maintaining high quality of implementation.

In several of the reports and studies examined, recovery was slow when compared with the efforts apparently exerted, and there is a need for a better understanding of the reasons for these modest results. Better-designed studies at sufficient scale are needed that will allow in-depth analysis. These should include process evaluation and better-defined outcomes. Adherence, rates

of weight and length gain, immune function and morbidity should be measured, and the data for wasted children should be analysed separately from those of non-wasted, stunted children. Robust methodologies are required with control or comparison groups.

Wasted children will gain weight rapidly if fed appropriate amounts of family foods, and it is rewarding and motivating for families, neighbours and health workers to see this striking transformation. Consideration should therefore be given to formulating nutrient requirements for faster rates of catch-up growth, as has been done recently for energy and protein [49], in addition to the nutrient requirements formulated for this Consultation for a gain of 5g/kg/day. Since severely malnourished children pass through a moderately malnourished state on their way to recovery, it is desirable from a practical, logistical standpoint to have the same dietary recommendations for moderate wasting as for rapid weight gain in severe wasting. To achieve rapid rates of weight gain with family foods, micronutrient supplements, including zinc, are likely to be needed. Multivitamins are usually available and dispersible zinc tablets are becoming more accessible. Thus to achieve rapid rates of weight gain (e.g. 10g/kg/day) for wasted children, an immediate practical step could be to recommend family foods plus a dispersible zinc tablet daily for 14 days (as for diarrhoea) and a multivitamin syrup (**Figure 1**).

Vitamin E emerged as a problem nutrient when the proposed requirement of 11.5mg/1000kcal was used [5]. This value is based on the Institute of Medicine's (IOM) figure, but if the FAO figure is used instead, or the age-specific IOM requirement is used, then vitamin E does not emerge as a problem nutrient. Zinc emerged as a problem nutrient when a tissue deficit was assumed, but a tissue deficit would be unlikely in non-wasted children. Zinc requirements depend on bioavailability, which in turn depends on the phytate:zinc molar ratio. This ratio was consistent with moderate bioavailability in all the patterns except Pattern 5, which was borderline. In the proposed nutrient requirements for moderate malnutrition [5], dietary iron is assumed to have moderate bioavailability (10% absorption). The bioavailability of food iron is difficult to estimate but may be higher when breastmilk is consumed [50] and it is possible that dietary iron adequacy has been underestimated in Pattern 1. Patterns 4-6 lacked haem iron, and the only enhancer of non-haem iron absorption present was vitamin C. Whether this iron is of moderate bioavailability will depend on whether the vitamin-C rich foods are eaten contemporaneously with the main dietary sources of iron and whether the enhancing effect of vitamin C is sufficient to offset the inhibiting factors in egg and spinach. If iron had a bioavailability of only 5% in Patterns 4-6 it would be a problem nutrient with an intake of <50% of that required.

In summary:-

- dietary counselling should be an integral part of treating malnutrition
- little emphasis is currently given to utilising family foods for the rehabilitation of malnourished children, whether moderate or severe
- current dietary recommendations made to mothers of moderately wasted or moderately stunted children are essentially the same as those given to mothers of well-nourished children
- generic dietary recommendations for well-nourished children (as developed by WHO and FAO) may meet the proposed requirements for moderate malnutrition if the recommendations are made slightly more prescriptive
- dietary counselling for moderately malnourished children should specifically reinforce the quantities of nutrient- and energy-dense foods that are needed for recovery

- successful rehabilitation of moderate malnutrition through dietary counselling demonstrates the value of local foods and could complement efforts to improve infant and young child feeding
- using data from Bangladesh and Ghana, linear programming identified vitamin E and zinc as possible problem nutrients in non-breastfed children, but the vitamin E requirement may be unduly high. Zinc was not a problem for children with no deficit in tissue zinc. Iron was identified as a possible problem nutrient in diets that had no meat
- calcium was identified as a possible additional problem nutrient in breastfed children
- in Bangladesh, rapid rates of weight gain averaging 10g/kg/day have been achieved with family foods and a zinc/iron/multivitamin supplement
- counselling about family foods should be considered for the management of moderate malnutrition in food-secure populations
- consideration should be given to formulating dietary guidelines that harmonize the dietary management of severe and moderate malnutrition.

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Table 1: Definitions and current treatment practices of moderate malnutrition by selected agencies and national programmes

AGENCY Country	ARE STUNTED, NON-WASTED CHILDREN INCLUDED?	USE NCHS OR WHO GROWTH REFERENCE?	INDICATOR USED FOR MODERATE MALNUTRITION							WT-FOR-AGE 60-74%	CURRENT PRACTICE AND FOCUS OF EMPHASIS REGARDING FAMILY FOODS	SPECIFIC MESSAGES ABOUT FAMILY FOODS	TARGET INTAKE FROM FAMILY FOODS	USE POSTERS CARDS ETC	CADRE OF WORKER	MONITOR WEIGHT g/kg/day target	ASSESSED IF COUNSELLING IS EFFECTIVE
			WT-FOR-HT <-2 to -3	WT-FOR-HT 70-<80%	WT-FOR-HT 70-<75%	MUAC 110- 115	MUAC 110-<120	MUAC 115-125	MUAC 110-125								
UN agencies & donors																	
FAO Afghanistan	YES Treat same as wasted	N/A no selection							YES	Mix of home foods with active feeding	YES ≥ 5 meals/d animal food energy- dense ½-1¼ cups per meal	YES RDIs	YES Poster (9 messages) Booklet	Wide- ranging including AEW LT	√ No criteria	-	NO
FAO Zambia	YES Treat same as wasted	N/A no selection							YES	Mix of home foods with active feeding	YES ≥ 5 meals/d animal food energy- dense ½-1¼ cups per meal	YES RDIs	YES Booklet	CHP PE	√ No criteria	-	NO
UNHCR Djibouti	NO	NCHS		YES						CSB premix RUTF (if HIV) Little emphasis on family foods	NO	NONE	YES Cards	RNP	NO	-	NO
UNHCR Ethiopia	NO	NCHS		YES						CSB premix Little emphasis on family foods	NO	NONE	YES IYCF cards	NS, OW CHW	√ 85% W/H	-	NO
UNHCR-GTZ Kenya	NO			YES				YES		Usual food + CSB premix Little emphasis on family foods	NO	NONE	YES Posters	CHW	√ 85% W/H	-	NO
UNHCR Tanzania	YES	NCHS		YES					YES	Mixed diet + family ration + CSB premix	NO	NONE	YES Posters	NW RS	√ ≥ 5		NO
UNHCR Uganda	NO	NCHS	YES							CSB/oil/sugar 3 food groups	NO	NONE	YES Food group posters	NA Nurses CHW	√ No criteria	-	NO
UNICEF Worldwide	NO	NCHS + promote WHO	YES	YES			YES	YES		Usual food + CSB or UNIMIX or BP5 or local mixtures	NO	NONE	YES IYCF materials	Variable	√ 85% W/H	-	NO

AGENCY Country	ARE STUNTED, NON-WASTED CHILDREN INCLUDED?	USE NCHS OR WHO GROWTH REFERENCE?	INDICATOR USED FOR MODERATE MALNUTRITION										CURRENT PRACTICE AND FOCUS OF EMPHASIS REGARDING FAMILY FOODS	SPECIFIC MESSAGES ABOUT FAMILY FOODS	TARGET INTAKE FROM FAMILY FOODS	USE POSTERS CARDS ETC	CADRE OF WORKER	MONITOR WEIGHT g/kg/day target	ASSESSED IF COUNSELLING IS EFFECTIVE	
			WT-FOR-HT <-2 to -3	WT-FOR-HT 70-<80%	WT-FOR-HT 70-<75%	MUAC 110- 115	MUAC 110-<120	MUAC 115-125	MUAC 110-125	WT-FOR-AGE 60-74%										
UNICEF Niger	NO	NCHS		YES									CSB/oil/sugar or UNIMIX/oil Little emphasis on family foods	NO	NONE	YES Cards	Nurses	√ 85% W/H	-	NO
UNICEF Uganda	NO	NCHS						YES		YES		Usual food + CSB/oil/sugar or BP5 or RUTF (if HIV)	NO	NONE	YES Variable	MW, HE, CHW Nurses	√	> 5	NO	
WFP Worldwide	YES Treat same as wasted	NCHS or WHO if national policy		YES				YES		YES		Mixed diet + CSB or WSB premix	SOME frequent energy- dense	NONE	YES Types vary by country	Variable	√ Variable criteria	-	NO	
WHO Worldwide	YES Emphasise animal food if stunted	WHO	YES						YES (<-2SD)			Individual assessment and counselling Mix of home foods with active feeding	YES case specific ≥ 5meals/d energy- dense	YES ¾-1 cup per meal Energy density 0.8- 1.0 kcal/g	YES IMCI cards and HIV/IF card	Variable -first and second level HW	NO		NO	
International NGOs																				
ACF Sudan S. Darfur	NO	NCHS		YES			YES (and/or W/H)					CSB food ration + RUF (Suppl. Plumpy) Little emphasis on family foods	NO	NONE	YES Unicef materials*	HE, HV, SA	√	≥ 3	NO	
ACF France Myanmar	NO	NCHS			YES	YES (and/or W/H)						Premix: (rice/ bean/sugar/oil) 3 food groups Vit A, Fe, folate Suppl	NO	NONE	YES Posters Booklets	HE	√	≥ 2.5	NO	
ACF USA E/C Africa, Tajikistan	NO	NCHS		YES		YES (and/or W/H)						CSB premix or UNIMIX 3 food groups	NO	NONE	YES Posters Booklet	HE	√	> 2	NO	
AFRICARE Guinea	YES Treat same as wasted	WHO										Family foods (PD/Hearth)	YES enriched, frequent, energy- dense	NONE	YES Posters Food prep demonstr ⁿ	NW CHW CV	√	-	YES	

AGENCY Country	ARE STUNTED, NON-WASTED CHILDREN INCLUDED?	USE NCHS OR WHO GROWTH REFERENCE?	INDICATOR USED FOR MODERATE MALNUTRITION										ASSESSED IF COUNSELLING IS EFFECTIVE				
			WT-FOR-HT <-2 to -3	WT-FOR-HT 70-<80%	WT-FOR-HT 70-<75%	MUAC 110- 115	MUAC 110-<120	MUAC 115-125	MUAC 110-125	WT-FOR-AGE 60-74%	CURRENT PRACTICE AND FOCUS OF EMPHASIS REGARDING FAMILY FOODS	SPECIFIC MESSAGES ABOUT FAMILY FOODS		TARGET INTAKE FROM FAMILY FOODS	USE POSTERS CARDS ETC	CADRE OF WORKER	MONITOR WEIGHT g/kg/day target
CARE Worldwide	YES	WHO							YES	Family food + CSB, WSB, oil cereals, pulses	YES home food production	NONE	YES Variable	CHW	√ Variable criteria	-	NO
CONCERN WORLDWIDE	NO	NCHS		YES				YES (or W/H)		CSB/oil/sugar Little emphasis on family foods	NO	NONE	YES Unicef materials*	MA, CV, NW, CM Nurses	NO	-	NO
W. Darfur CONCERN WORLDWIDE	NO	NCHS		YES				YES		Mixed diet + CSB premix	SOME protein, fruit, green leaves	NONE	YES	HE CHW	√	> 3	NO
S. Sudan CONCERN WORLDWIDE	NO	NCHS		YES						Complementary foods + CSB premix	NO	NONE	YES IYCF posters	CHW CV, TBA	√	≥ 2.5	NO
Niger CONCERN WORLDWIDE	NO	NCHS		YES				YES		Family ration + CSB premix Vit A, Fe, folate suppl Little emphasis on family foods	NO	NONE	YES Unicef posters	Nurses HE, OW CV	√	≥ 2	NO
DRC CWS Indonesia	NO	WHO	YES (<-1.5SD in some places)							Family food + WSB + Sprinkles or vit A suppl	NO	NONE	YES Posters Flipchart		√	-	NO
DREAM (9 African countries: all beneficiaries are HIV+ve)	YES Treat same as wasted	NCHS	YES					YES (<-2SD)		Mixed diet + CSB or other cereal/legume mix + DSM. Individual counseling	YES ≥ 5 meals/d animal food (egg meat, fish milk)	NONE	YES Booklet	Peers Nurses	√	- No criteria	NO
FOOD FOR THE HUNGRY Bolivia DRC Kenya	YES Treat same as wasted	WHO					YES	YES (<-2SD)		Family ration + CSB/oil, WSB (PD/Hearth)	YES ≥ 5 meals/d energy- dense	YES 6-800kcal 20-26g protein, 4000 IU vit A per meal	YES IMCI cards	NA CHW Peers	√	> 5 th centile gain in W/A	YES

AGENCY Country	ARE STUNTED, NON-WASTED CHILDREN INCLUDED?	USE NCHS OR WHO GROWTH REFERENCE?	INDICATOR USED FOR MODERATE MALNUTRITION										CURRENT PRACTICE AND FOCUS OF EMPHASIS REGARDING FAMILY FOODS	SPECIFIC MESSAGES ABOUT FAMILY FOODS	TARGET INTAKE FROM FAMILY FOODS	USE POSTERS CARDS ETC	CADRE OF WORKER	MONITOR WEIGHT g/kg/day target	ASSESSED IF COUNSELLING IS EFFECTIVE	
			WT-FOR-HT <-2 to -3	WT-FOR-HT 70-<80%	WT-FOR-HT 70-<75%	MUAC 110- 115	MUAC 110-<120	MUAC 115-125	MUAC 110-125	WT-FOR-AGE 60-74%										
GOAL Ethiopia	NO	N/A (as use MUAC)					YES						Mixed diet +famix/oil Vit A suppl	YES ≥ 3 meals/d enriched porridge	NONE	YES Posters Booklets	OW CHP Nurses	√ No criteria	-	NO
GOAL Malawi	YES if in PD/Hearth	NCHS		YES			YES				YES (<-2SD)		CSB (RUTF if HIV) 6 food groups (PD/Hearth)	SOME frequent energy- dense	NONE	YES Posters	HSA Nurses	√ or >200g in 12d for PD/ Hearth	>5	NO
GRET Madagascar Vietnam, Burkina Faso	YES Include well- nourished	N/A no selection											Fortified locally- developed food for 6-23m. No emphasis on family foods	NO	NONE	YES Posters Cards Leaflets	N/A	NO	-	NO
HKI W. Africa	YES (Some)	NCHS		YES							YES (rural Niger)		Mixed diet +CSB/sugar/oil	YES 3-4 meals enriched porridge nutrient – dense	NONE	YES	CHW CV	√ 85% W/H	-	NO
IRC-UNHCR Kenya	NO	NCHS		YES						YES			Mixed diet + CSB premix (RUTF if have complications) Vit A, Fe, folate suppl food pyramid	SOME diversity micro- nutrients	NONE	YES IYCF materials	NW, Nut CHW Nurses	√ 80% W/H	-	YES (not accessible)
I-LIFE Malawi	YES	NCHS									YES (<-2SD)		6 food groups (PD/Hearth)	YES enriched porridge egg, meat, insects,fats	NONE	YES Flip charts	CHW CV	√ 400g in 2 weeks		NO
MSF Spain Uganda	NO	WHO	YES				YES (screen on this then do W/H)						CSB premix (being replaced by RUF) Vit A/ Fe suppl 3 food groups	NO	NONE	NO	HE	√ > 3		YES (not accessible)
MSF Suisse Niger Sudan Somalia	NO	NCHS or WHO	<-3SD if use WHIO	YES If use NCHS									RUTF Little emphasis on family foods	NO	NONE	NO	N/A	√ ≥ 3		NO

AGENCY Country	ARE STUNTED, NON-WASTED CHILDREN INCLUDED?	USE NCHS OR WHO GROWTH REFERENCE?	INDICATOR USED FOR MODERATE MALNUTRITION										CURRENT PRACTICE AND FOCUS OF EMPHASIS REGARDING FAMILY FOODS	SPECIFIC MESSAGES ABOUT FAMILY FOODS	TARGET INTAKE FROM FAMILY FOODS	USE POSTERS CARDS ETC	CADRE OF WORKER	MONITOR WEIGHT g/kg/day target	ASSESSED IF COUNSELLING IS EFFECTIVE		
			WT-FOR-HT <-2 to -3	WT-FOR-HT 70-<80%	WT-FOR-HT 70-<75%	MUAC 110- 115	MUAC 110-<120	MUAC 115-125	MUAC 110-125	WT-FOR-AGE 60-74%											
SC-UK 6 African countries, Afghanistan	NO	NCHS		YES							YES		Mixed diet + CSB/sugar/oil	SOME nutrient rich foods	NONE	YES Variable	HCS NW, CM	√ No criteria	-	NO	
TERRE DES HOMMES Burkina Faso	NO	NCHS		YES							YES		Individual/group counselling on food preparation and hygiene. Vit A suppl.	YES enriched porridge	NONE	YES Food prep demonstr ⁿ	CHP	√ 85% W/H or MUAC >125	-	NO	
TERRE DES HOMMES Senegal Guinea	NO	NCHS + promote WHO		YES							YES		3 food groups Vit A suppl.	YES rice flour, soya, fish flour, eggs pulses, oil	NONE	YES Posters	CHP CV	√ No criteria	-	YES	
VALID Ethiopia Malawi Sudan Zambia	NO	NCHS (WHO if national policy)		YES							YES		Usual food + CSB premix	NO	NONE	YES Variable	CHW OW	√ 85% W/H	-	NO	
WORLD VISION Niger	YES Emphasise <i>Moringa</i> leaf powder with peanut paste + Vit A 400re Fe 10mg Zn 3-5mg Vit C			YES							YES		CSB premix or UNIMIX 3 food groups Vit A suppl	YES energy- dense		YES cards posters	Nurses CHW NW	√ 85% W/H	> 2.5	YES?	
National programmes																					
Bangladesh BNNP	YES Treat same as wasted	WHO										YES	Premix (rice/ lentil/oil/ molasses) 5 food groups Vit A suppl	YES rice, lentils vegetables fish, fruit	NONE	YES Posters Flipcharts Booklets	CHP NS CV	√ 7-12m 300-400g/m 13-24m 150- 200g/month		YES	
Bolivia	YES Give Zn 10mg/day for 12wks	WHO	YES										Family food + RUTF	NO	NONE	YES Booklet	HCS	√ No criteria	-	NO	

AGENCY Country	ARE STUNTED, NON-WASTED, CHILDREN INCLUDED?	USE NCHS OR WHO GROWTH REFERENCE?	INDICATOR USED FOR MODERATE MALNUTRITION								CURRENT PRACTICE AND FOCUS OF EMPHASIS REGARDING FAMILY FOODS	SPECIFIC MESSAGES ABOUT FAMILY FOODS	TARGET INTAKE FROM FAMILY FOODS	USE POSTERS CARDS ETC	CADRE OF WORKER	MONITOR WEIGHT g/kg/day target	ASSESSED IF COUNSELLING IS EFFECTIVE	
			WT-FOR-HT <-2 to -3	WT-FOR-HT 70-<80%	WT-FOR-HT 70-<75%	MJAC 110- 115	MJAC 110-<120	MJAC 115-125	MJAC 110-125	WT-FOR-AGE 60-74%								
Brazil	YES Treat same as wasted	WHO								YES (<-2SD)	Family food	YES 10 steps for CF	NONE	YES Variable	CHW	√ No criteria	-	NO
India ICDS	YES Treat same as wasted	NCHS								YES	Usual food + cooked meal (rice/lentil oil/molasses)	NO	NONE	YES Varies by State	AWW	√ No criteria	-	NO
India IMNCI	YES Treat same as wasted	NCHS								YES	Family foods Individual assessment and counselling	YES case- specific	YES ¼-2 cups per meal	YES IMCI mothers' card	AWW CHW	√ No criteria	-	NO

Abbreviations re Table 1

AEW agriculture extension worker; AWW anganwadi worker; CHP community health/nutrition promoter; CHW community health worker; CM community mobiliser; CV community volunteer; HCS health centre staff; HE health educator; HSA health surveillance assistant; HV home visitor; LT literacy teacher; MA medical assistant; MW midwife; NA nursing assistant; NS nutrition supervisor; Nut nutritionist; NW nutrition worker/assistant; OW outreach worker/health extension worker; PE peer educator; RNP refugee nutrition promoter; RS refugee supervisor; SA social animator; TBA traditional birth attendant

* Unicef booklet includes how to prepare CSB, breastfeeding, child care (play), hygiene (personal, environmental).

N/A: Not applicable

RUF: ready-to-use food; RUTF: ready-to-use therapeutic food

PD/Hearth: Positive Deviance/Hearth approach

Table 2. Linear programming models: Foods included (column 1) and best food combinations (g/day) to meet requirements for catch-up growth (5g/kg/d) for Bangladesh child aged 12-15m. Amounts for Patterns 1-7 represent amounts averaged over 7 days.

Food type	Maximum amount in model (g/day)	Breastfed All foods allowed <i>Pattern 1</i>	Not breastfed All foods allowed <i>Pattern 2</i>	Not breastfed No liver <i>Pattern 3</i>	Not breastfed No liver, chicken, fish <i>Pattern 4</i>	Not breastfed No liver, chicken, fish, egg <i>Pattern 5</i>	<i>Pattern 5</i> but with lower requirement for vit E and Zn <i>Pattern 6</i>	Lower requirement vit E & Zn: one animal food/day <i>Pattern 7</i>
Breast milk	530	530	-	-	-	-	-	-
Staples								
Rice	195	100	100	101	106	120	100	100
Chapati	75	37	37	75	75	75	58	68
Semolina	20	0	0	0	3	20	8	0
Rice noodles	70	0	0	0	0	0	0	0
Bread	75	0	0	0	0	0	0	0
Legumes								
Lentils	80	67	67	67	71	80	67	67
Animal foods								
Chicken liver	35	10	10	-	-	-	-	5
Chicken	95	0	0	0	-	-	-	0
Fish	75	34	54	75	-	-	-	6
Egg	50	0	50	50	50	-	-	39
Cows milk	1000	0	259	263	252	267	275	255
Roots/tubers								
Potato	125	0	0	0	0	0	0	0
Vegetables								
Pumpkin	130	130	130	130	130	130	130	130
Spinach	40	40	40	40	44	40	40	40
Fruit								
Banana	115	12	0	0	0	0	0	0
Mango	80	0	0	0	0	0	42	6
Orange/juice	180	0	0	0	0	0	0	0
Pawpaw	155	107	120	71	143	140	155	155
Guava	25	25	25	25	25	25	12	25
Coconut jelly	20	0	0	0	0	0	0	0
Oils/sugar								
Soy oil	35	0	10	2	5	2	13	8
Gur sugar	20	0	0	0	0	0	0	0

Table 3. Percentage of requirements met by the 7 models for a weight gain of 5g/kg/d for Bangladeshi child aged 12-15 months (weight 6.7kg, energy requirement 770kcal/d)

Nutrient	Requirement /1000kcal	Breastfed All foods allowed <i>Pattern 1</i> (%)	Not breastfed All foods allowed <i>Pattern 2</i> (%)	Not breastfed No liver <i>Pattern 3</i> (%)	Not breastfed No liver, chicken, fish <i>Pattern 4</i> (%)	Not breastfed No liver, chicken, fish, egg <i>Pattern 5</i> (%)	<i>Pattern 5</i> but with lower requirement vit E and Zn* <i>Pattern 6</i> (%)	Lower requirement vit E & Zn*: one animal food/day <i>Pattern 7</i> (%)
Protein g	24	145	210	229	173	157	137	171
Vitamin A µg	960	389	399	194	271	255	294	356
Vitamin E mg	11.5 7.6	60	75	69	63	51	97	100
Vitamin C mg	75	258	238	183	258	255	245	273
Thiamin µg	600	109	122	122	100	108	100	102
Riboflavin µg	800	123	206	169	163	128	126	176
Niacin mg	8.5	180	216	234	187	181	159	191
B ₆ µg	800	100	119	125	118	122	111	116
Folate µg	220	212	210	170	186	185	172	198
B ₁₂ µg	1	895	1094	434	203	138	143	564
Pantothen mg	2.7	165	203	187	169	146	135	175
Ca mg	600	61	100	100	100	100	100	100
P mg	600	100	164	185	147	140	125	145
Mg mg	200	97	108	126	121	124	111	117
K mg	1400	144	162	158	152	152	150	154
Na mg	550	35	63	64	56	44	45	55
Fe mg	9	89	100	100	100	99	86	100
Zn mg	13 5.4	38	49	51	49	48	100	116
Cu µg	680	125	100	108	110	121	105	108
Mn mg	1.2	535	192	239	245	266	219	231
Phytate:Zn <15		✓	✓	✓	✓	15.7	✓	✓
	Problem nutrients (<95% of needs met)	Vit E Ca Fe Zn	Vit E Zn	Vit E Zn	Vit E Zn	Vit E Zn	Fe	Nil

* This model used lower requirements for vit E (7.6mg/1000kcal = age-specific requirement) and Zn (5.4mg/1000kcal = requirement assuming no tissue Zn deficit)

Table 4: Studies of malnourished children treated at home by dietary counselling (no food provided)

AUTHORS COUNTRY YEAR PUBLISHED (ref)	TYPE OF STUDY URBAN / RURAL	AGE: ADMISSION CRITERIA or SEVERITY OF MALNUTRITION IMPLEMENTER	CHILDREN STUDIED FOCUS OF COUNSELLING	REHABILITATION					FOLLOW-UP			
				DURATION OF INTERVENTION	MICRONUTRIENT SUPPLEMENT	CASE FATALITY RATE (%)	RELAPSE (%)	MORBIDITY	WEIGHT GAIN OR PROGRESS	COST PER CHILD	FOLLOW-UP	LATER MORTALITY (%)
Husaini et al. Indonesia 1982 (ref 32)	O	6-36 months Grade III (Gomez) or oedema but not severely ill OTP nutrition clinic	108 skimmed milk	3 months 5 counselling visits at home No micronutrients given		CFR Relapse Morbidity	16.6% NR NR	In a subset (n=49):- Mean weight gain 12g/d Mean wt gain 1.7g/kg/d* At entry, 12% were ≥80% wt/ht After 6m, 84% were ≥80% wt/ht	NR	Not done	NR	NR
Castillo et al. Chile 1983 (ref 33)	O urban	<12 months Wt/age <-2SD to >-3 SD OTP health centers and a nutrition clinic	294 a) 250 at 10 health centers b) 44 at nutrition clinic a) no details b) individual counselling	NR No micronutrients given		CFR Relapse Morbidity	NR NR NR	3m later in the subset (n=274) of those <-2SD and >-3 SD wt/age:- a) 31% reached -1SD wt/age b) 73% reached -1SD wt/age	NR	Not done	NR	NR
Glatthaar et al. South Africa 1986 (ref 34)	RCT urban slum	7-36 months Mean age 18 mo Mostly moderate cases ≤ 72% wt/age or ≤ 79% wt/age + oedema or wt/ht <95% OTP hospital	140 a) 65 b)75 controls 5-6 meals/day energy-dense porridge staple +low cost protein foods +vegetables	3 months a) 6 counselling visits at home b) No visits (controls) No micronutrients given		CFR:- a) 11.7% b) 5.4% controls Relapse Morbidity:- High incidence of diarrhea		Mean wt/ht (NCHS):- (a) (b) at entry 81% 82% after 3m 88% 87% Mean ht/age (NCHS):- at entry 90% 90% after 3m 89% 89%	NR	9m later wt/ht:- a) 91% b) 91%	a) 0 b) 0	NR
Fernandez- Concha et al. Peru 1991 (ref 35)	O urban slum	Mean age 18 mo Grades II & III (Gomez) 87% were moderate Mean wt/ht ~88%	54 ≥4 meals/day breastfeed + energy dense, protein-rich	12 months Home visits by doctor and nurse in week 1. Then weekly clinic visits		CFR Relapse Morbidity	0% 0% NR	% wt/age:- grade II grade III at entry 87% 13% after 3m 47% 2%. After 12m 19% 0%	\$21/child	Not done	NR	NR

AUTHORS COUNTRY YEAR PUBLISHED (ref)	TYPE OF STUDY URBAN / RURAL	AGE: ADMISSION CRITERIA or SEVERITY OF MALNUTRITION IMPLEMENTER	CHILDREN STUDIED FOCUS OF COUNSELLING	REHABILITATION					FOLLOW-UP		
				DURATION OF INTERVENTION	MICRONURIENT SUPPLEMENT	CASE FATALITY RATE (%)	RELAPSE (%)	MORBIDITY	WEIGHT GAIN OR PROGRESS	COST PER CHILD	FOLLOW-UP
Bredow & Jackson Jamaica 1994 (ref 36)	O rural	<3 years Grades II & III (Gomez) or oedema Mean age 16 mo for grade II Health centre	meals + fruit and vegetables 36 (rural clinic) breastfeed + high energy milk + family food	No micronutrients given Mean 5.6 months Mean 6 clinic visits: weekly if ill, otherwise monthly Fe, multivitamins, and folic acid given for 1mo		CFR 2.7% Relapse 0 Morbidity NR	Mean wt gain 1.4g/kg/d* if grade II Mean wt/age mean ht/age At entry 62% 89% 5.6m later 73% 88%	\$14 for medicines	NR	NR	NR
Khanum et al. Bangladesh 1994 (ref 24,25)	RCT-S urban poor	12-59 months <60% wt/ht and/or oedema Mean wt/age 48% Mean wt/ht 67% Mean ht/age 84 98% had oedema Mean age 25 mo Save the Children nutrition rehabilitation unit	437 a) 173 inpatient b) 134 day-care c) 130 1wk day care and then at home 3 energy dense, protein-rich meals with vegetables + 2 snacks + 4 milk drinks	Until ≥80% wt/ht and oedema-free. Mean days taken:- a) inpatient: 18 days b) day-care: 23 days c) domiciliary 35days Fe and multivitamins given to take home Child given own bowl to take home		CFR:- a) 3.5 b) 5.0 c):3.5 Relapse a) 0 b) 0 c) 0 Morbidity:- High incidence of diarrhea, ARI, skin infections.	Mean wt gain during recovery to 80% wt/ht:- a) inpatient: 11g/kg/d b) day-care: 6g/kg/d c) domiciliary 4g/kg/d (all are underestimates as these include resolution of oedema) Mean ht gain during recovery to 80% wt/ht:- a) inpatient: 0.6cm b) day-care: 0.2cm c) domiciliary 0.7cm	Cost to centre to rehabilitate a)\$156 b)\$59 c)\$29	12m later:- mean wt/ht a) 91% b) 91% c) 91% mean ht/age a) 84% b) 84% c) 84%	a) 3.4 b) 1.5 c) 1.5	a)1.2 b) 0.7 c) 0
Ahmed et al Bangladesh 2002 (ref 27)	RCT urban poor	6-60 months <-3SD wt/ht and/or oedema	225 a) inpatient b)home visits c) clinic visits (75/group) ≥6 meals/day energy dense meals (milk suji, khichuri, halwa),	Until ≥80% wt/ht and oedema-free. Median days taken:- a) 17 days b) 20 days c) 37 days Fe, Zn, folic acid and multivitamins given		CFR:- a) 1.3 b) 0 c) 0 Relapse NR Morbidity NR	Mean weight gain:- a) 11.9 g/kg/d b) 9.9 g/kg/d c) 7.5 g/kg/d (a) vs (b) not significantly different	Cost to centre to rehabilitate a)\$ 76 b)\$ 21 c)\$ 22	NR	NR	NR

AUTHORS COUNTRY YEAR PUBLISHED (ref)	TYPE OF STUDY URBAN / RURAL	AGE: ADMISSION CRITERIA or SEVERITY OF MALNUTRITION IMPLEMENTER	CHILDREN STUDIED FOCUS OF COUNSELLING	REHABILITATION						FOLLOW-UP		
				DURATION OF INTERVENTION	MICRONURIENT SUPPLEMENT	CASE FATALITY RATE (%)	RELAPSE (%)	MORBIDITY	WEIGHT GAIN OR PROGRESS	COST PER CHILD	FOLLOW-UP	LATER MORTALITY (%)
Schroeder et al. Vietnam 2002 (refs 20,37,38)	RCT rural	5-15 months Wt/age <-2SD to >-3 SD (most were stunted) Save the Children integrated nutrition programme Hearth model	35 (subset) a) 16 intervention b) 19 control energy-dense meals	12-day sessions No micronutrients given		CFR Relapse Morbidity ARI reduced in intervention	0 NR	Difference from baseline in mean WAZ- after 4m (a) (b) -0.05 -0.25 Difference from baseline in mean HAZ- after 4m -0.20 -0.50	NR	8m later change in mean WAZ a) -0.11 b) -0.24 mean ht/age a) -0.10 b) -0.52	NR	NR
Roy et al. Bangladesh 2004 (ref 30 + personal communication)	RCT urban poor	6-24 months 61-75% wt/age community nutrition centers a) and b) graduate health assistants c) centre staff	282 a) twice weekly group education b) twice weekly educ ⁿ + food c) fortnightly educ ⁿ by BINP ≥5 meals/day energy dense meals (khichuri)	3 months No micronutrients given		CFR Relapse Morbidity:- High incidence of diarrhea and fever	NR NR	Mean wt/age:- at entry (a) (b) (c) -2.80 -2.90 -2.90 after 3m -2.51 -2.36 -2.79 Mean ht/age:- at entry (a) (b) (c) -2.39 -2.48 -2.15 after 3m -2.55 -2.16 -2.34	NR	3m later mean wt/age a) -2.41 b) -2.15 c) -2.84 mean ht/age a) -2.43 b) -2.05 c) -2.46	NR	NR
Roy et al. Bangladesh (ref 31 + personal communication)	RCT urban poor	6-24 months 61-75% wt/age community nutrition centers	579 a) twice weekly group education for 6m b) weekly group education for 3m and then fortnightly for 3m ≥5 meals/day energy dense meals (khichuri)	6 months No micronutrients given		CFR Relapse Morbidity:- High incidence of fever and respiratory tract infections in both groups	0 NR	Mean wt/age:- at entry (a) (b) -2.72 -2.78 after 3m -2.45 -2.50 Mean ht/age:- at entry -2.66 -2.71 after 3m -2.77 -2.76	NR	9m later mean wt/age a) -2.38 b) -2.37 mean ht/age a) -2.80 b) -2.80	NR	NR

List of Abbreviations used in Table 4

wt/ht = weight-for-height
wt/age = weight-for-age

MUAC = mid-upper arm circumference

NR = not reported

O = observational study

CC = case control study

RCT = randomised controlled trial

RCT-S = systematic allocation

Annex 1: Working example: Using WHO job aid - recommended foods appropriate for Bangladesh (115 kcal/kg/day, P/E 12%; Energy density 1.1 kcal/g)

Morning	g	kcal	Protein g	Phytic acid	Vit A µgRE	Vit E mg	Vit C mg	thiamin mg	ribofl mg	niacin mg	B ₆ mg	Folate µg	B ₁₂ mg	Ca mg	Fe Mg	Zn mg
Rice	58	75	1.4	35	-	-	-	0.01	0.01	0.5	0.05	1.2	-	1.7	0.12	0.23
Milk	50	33	1.6	-	27	0.05	-	0.02	0.08	0.4	0.05	3	0.2	57	0.05	0.2
Sugar	7	28	-	-	-	-	-									
Snack																
Chapatti	50	60	1.7	47	-	0.25	-	0.01	0.05	2.5	0.08	8.4	-	7.7	1.1	0.78
Egg	50	77	6.3	-	95	1.0	-	0.04	0.25	1.3	0.05	22.0	0.55	25	0.6	0.55
Midday khichuri	158															
Rice	80	104	1.9	48	-	0.01	-	0.02	0.02	0.7	0.08	1.6	-	1.7	0.16	0.32
Lentils	30	35	2.7	107	-	0.33	-	0.06	0.03	0.7	0.06	60	-	5.4	0.99	0.39
Leaves	20	5	0.6	-	82	0.2	2	0.02	0.05	0.24	0.04	29	-	27	0.72	0.2
Pumpkin	23	5	0.1	-	46	0.23	1	0.01	-	0.1	-	3	-	1.6	0.05	0.05
Oil	5	44	-	-	-	0.4	-	-	-	-	-	-	-	-	-	-
Snack Pawpaw	155	60	0.9	-	209	1.55	96	0.05	0.05	0.06	-	59	-	36	0.15	0.15
Evening Meal	182															
Rice	80	104	1.9	48	-	0.01	-	0.02	0.02	0.7	0.08	1.6	-	1.7	0.16	0.32
Dhal	30	35	2.7	107	-	0.33	-	0.06	0.03	0.7	0.06	60	-	5.4	0.99	0.39
Potato	20	19	0.4	16	-	0.01	3	0.05	-	0.38	0.06	2	-	1	0.08	0.06
Leaves	20	5	0.6	-	82	0.2	2	0.02	0.05	0.24	0.04	29	-	27	0.72	0.2
Oil	7	62	-	-	-	0.6	-	-	-	-	-	-	-	-	-	-
Guava	25	13	0.2	-	10	0.25	46	0.01	0.02	0.4	0.02	3.5	-	5	0.08	0.05
TOTAL	695	764	23.0	408	551	5.4	150	0.40	0.66	8.9	0.7	283	0.7	204	6.0	4.1
Required[5]		770	18.4		739	8.8	57	0.46	0.61	6.5	0.6	169	0.7	462	6.9	10
% required					75%	61%		87%						44%	87%	41%

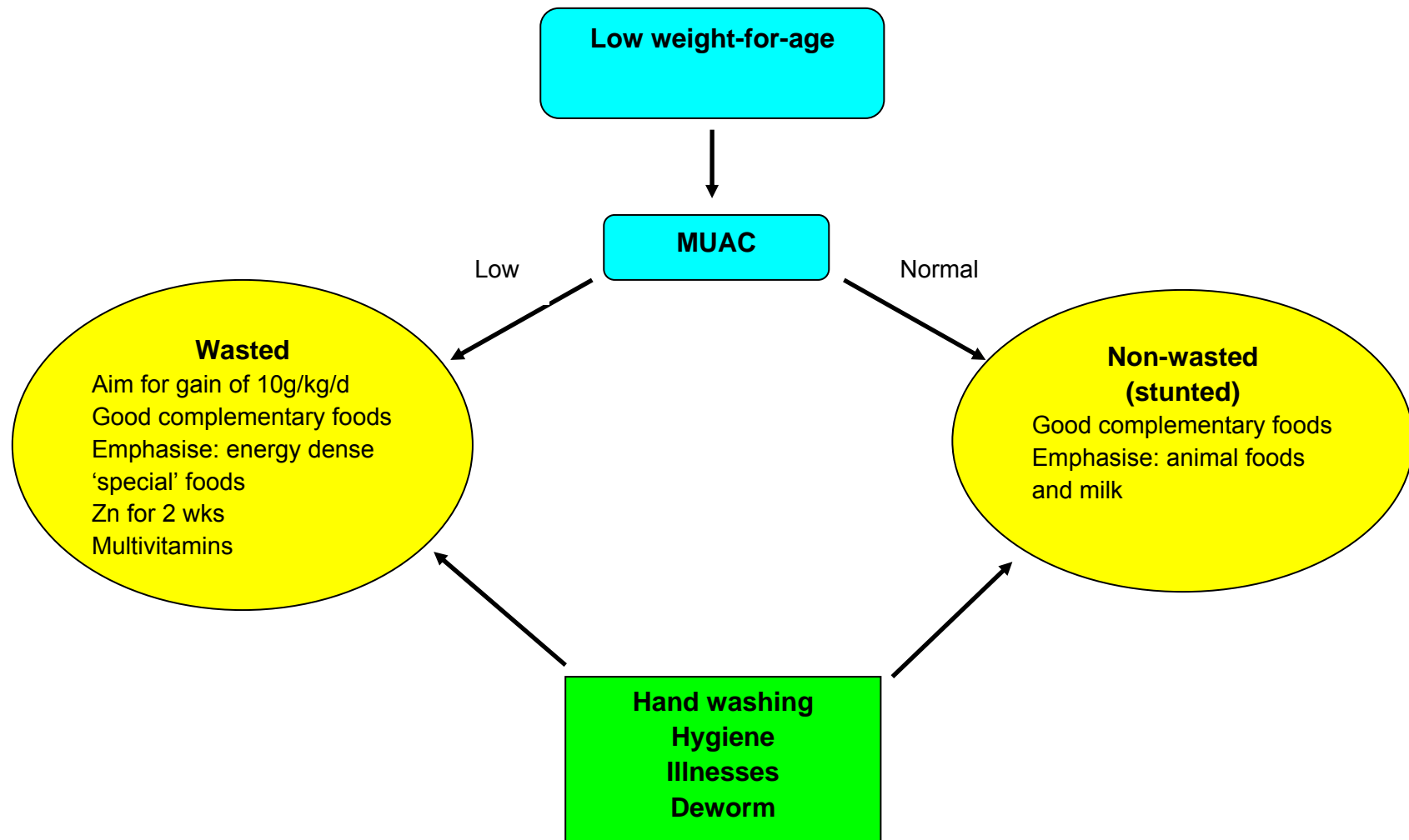


Figure 1: Diagram showing differential dietary management of moderately wasted and non-wasted moderately stunted children. (MUAC mid upper arm circumference)