Proceedings of the World Health Organization/ UNICEF/World Food Programme/United Nations High Commissioner for Refugees Consultation on the Management of Moderate Malnutrition in Children under 5 Years of Age

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Introduction

Moderate malnutrition includes all children with moderate wasting, defined as a weight-for-height between –3 and –2 z-scores of the World Health Organization (WHO) child growth standards, and all those with moderate stunting, defined as a height-for-age between –3 and –2 z-scores of the WHO child growth standards [1]. Most of these children will be moderately underweight (weight-for-age between –3 and –2 z-scores). Moderate malnutrition affects large numbers of children in poor countries, placing them at increased risk of mortality. A recent analysis of data from 388 national surveys from 139 countries from 2005 has provided an estimate that about 36 million children aged 6 to 59 months are suffering from moderate wasting. Approximately 178 million are estimated to be stunted [2]. Moderate malnutrition increases the risk of death from common diseases and, if not adequately treated, may worsen, resulting in severe acute malnutrition (severe wasting and/or edema) and/or severe stunting (height-for-age < –3 z-scores), which are both life-threatening conditions. Therefore, the management of moderate malnutrition is a public health priority.

In contrast to severe malnutrition, programs for the management of moderate malnutrition in children have remained virtually unchanged for the past 30 years, although it seems likely that this form of malnutrition is associated with a larger proportion of nutrition-related deaths than severe malnutrition.

WHO convened a meeting in Geneva from 30 September to 3 October 2008 to address this problem. The overall aim of the meeting was to answer the question "What diets should be recommended to feed moderately malnourished children?"* The general objectives of the meeting were to identify areas of consensus on the nutrient needs and dietary management of moderate malnutrition in children that can be translated into evidence-based global guidelines, and to identify knowledge gaps that should be addressed by research, both in the area of dietary management and in the modalities for providing that diet.

The specific objectives of the meeting were:

» To provide an estimate of the nutritional requirements of children with moderate malnutrition, examining wasted and stunted children separately;
» To examine current approaches for the management of moderate malnutrition, based either on dietary counseling or on the provision of food supplements;
» To formulate recommendations to improve the dietary management of moderate malnutrition.

The expected outcomes of the meeting were:

» Preliminary recommendations for the management of moderate malnutrition, with a detailed research agenda to generate evidence needed to strengthen these preliminary guidelines;
» Recommendations for feeding children with moderate malnutrition for the Codex Alimentarius working group developing standards of food products for underweight children.

In the absence of specific recommendations, it was also assumed during this meeting that children with severe stunting would benefit from a diet adapted for moderately stunted children and that children suffering from growth faltering would benefit from a diet adapted for wasted or stunted children, depending on the nature of their growth deficit.

In absence of a strong evidence base to make

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This report contains the collective views of an international group of experts and does not necessarily represent the decisions or the stated policy of the World Health Organization.

* Another WHO consultation is planned to review the evidence on strategies and programmatic approaches to managing moderate malnutrition that aims to answer questions not addressed in this meeting.

recommendations in many areas related to the management of moderate malnutrition, the Consultation was the start of a process of developing guidance in this area. Recommendations made in this report only reflect the participants' opinions and should not be regarded as formally endorsed by WHO. For the time being, research organizations are encouraged to fill the knowledge gaps identified in this meeting so that recommendations can soon be developed based on solid evidence.

Four background papers were commissioned by WHO in advance of the meeting and circulated among the participants. In addition to these background papers, a call for abstracts was circulated to a large number of agencies implementing programs or carrying out research on the management of moderate malnutrition. During the meeting, authors were asked to present key elements of their initiatives to improve the management of moderate malnutrition.

The presentations were followed by discussions and working group sessions to develop consensus statements and identify areas for research on the improved dietary management of moderate malnutrition. The consensus statements, discussion, and research are presented below under four central themes related to the contents of the four background papers.

Nutrient content of diets suitable for feeding moderately malnourished children (Paper 1)

This background paper (prepared by Mike Golden, Emeritus Professor, Aberdeen University) provides tentative recommendations for diets suitable for feeding children with moderate malnutrition, expressed in nutrient densities per 1,000 kcal.

The paper examined separately requirements of type I and type II nutrients. Type 1 nutrients are those whose deficiencies translate into characteristic clinical symptoms associated with the dysfunction of a particular biochemical pathway. Type II nutrients are those needed for the growth of lean tissues. Tentative recommendations for the quantities of type I nutrients needed by children with moderate malnutrition were based on the need to replenish body stores and to re-establish the compromised biochemical function, taking into account additional needs resulting from an increased exposure to stress and infections. Tentative recommendations of intakes of type II nutrients were made based on a factorial method, taking into account the expected lean tissue deposition and possible malabsorption. The estimations of type II nutrient requirements were based on theoretical optimal weight and height gains, acknowledging that these weight and height gains are rarely observed in practice. The paper also discussed the role that antinutrients play in determining the absorption of both type I and type II nutrients and emphasized that the recovery of children with moderate malnutrition should not be judged only on the basis of weight gain. A high weight gain can be related to an increase of fat tissue, with an inadequate restoration of lean body mass and physiological functions. In this regard, height gain that is accompanied by an increase in lean body mass is a better indicator of recovery than weight gain. It is important to examine body composition and other physiological functions, such as immunological functions and cognitive development, when evaluating the efficacy of a new diet. To achieve optimal growth and full functional recovery, it is essential to provide all nutrients needed by children with moderate malnutrition. Approaches putting emphasis on single nutrients are misguided and should be abandoned.

The presentation by Nigel Rollins (WHO) on managing the needs of HIV-infected children emphasized how little is known about the relationship between HIV and moderate malnutrition in infected children and how there is currently no basis for recommending different nutritional management for these children, apart from increased energy intake, as compared with non-HIV-infected children. The current WHO Guidelines on Integrating Nutrition into the Care of HIV-Infected Children [3] utilize experiences and practices from caring for HIV-uninfected children with growth faltering and some basic knowledge of the relationship between HIV disease progression and nutritional status. However, there are still a number of research areas where comparative trials are needed to determine optimal care and interventions.

A presentation by Mark Manary (St. Louis Children's Hospital) on recent attempts to supplement the diet of children with moderate malnutrition to prevent kwashiorkor in Malawi highlighted the lack of an evidence base to make specific recommendations for the dietary management of moderate malnutrition in children in areas of high kwashiorkor prevalence. The presentation made clear that fundamental research to better understand the pathophysiology of kwashiorkor is needed to improve current programs in these areas.

After the discussion and working group sessions that followed these presentations, the participants agreed on the following statements about diets suitable for feeding moderately malnourished children:

» The nutritional requirements of moderately malnourished children probably fall somewhere between the nutritional requirements for healthy children and those for children with severe acute malnutrition during the catch-up growth phase.
» The nutrient intakes of moderately malnourished children need to be adequate to allow wasted children to synthesize the lean tissue deficits and to allow stunted children to achieve both accelerated linear growth and associated accrual of lean tissue.

Whereas most previous research has focused on the rehabilitation of severely wasted and/or edematous children, there is some evidence that stunted children can also recover previous deficits in linear growth. However, there is less research available to document the extent and velocity of such recoveries of linear growth and the related nutritional needs. It is uncertain also whether improved linear growth during rehabilitation is associated with recovery of other deficits, such as cognitive deficits associated with stunting.

» Diets with a nutrient density equivalent to that of F100 and a low antinutrient content, provided at an energy intake to support the desired rate of weight gain, are adequate to promote height and weight gain and may also be effective at restoring functional outcomes, including physiological and immunological function toward normal, in moderately wasted children. However, diets with a lower density of some nutrients, notably potassium and zinc, may also accomplish these goals.

» Some nutrients can interact; for instance, iron can limit the effects of zinc, an excess of zinc can induce a copper deficiency, and a magnesium deficiency can have an effect on potassium retention. Attention should be given to these possible interactions when deciding about fortification levels.

» Diets with a nutrient density in relation to energy equivalent to that of F100 have been used without apparent adverse effects on hundreds of thousands of children with severe acute malnutrition and compromised physiological functions. They are unlikely to have adverse effects on moderately wasted children. However, there are insufficient data to show whether the resulting tissue deposition and body composition are optimal.

» Energy requirements of moderately malnourished children increase in relation to the rate of weight gain during catch-up growth. Energy requirements also depend on the type of tissue deposition, as 1 g of fat tissue requires about 8 kcal/g for synthesis, in contrast to 1.8 kcal/g for lean tissue. A low weight gain in relation to energy intake may be due to preferential fat deposition as a result of an inadequate supply of nutrients needed for the accumulation of lean tissue.

» Wasted children can put on weight (recover) at a rate of 5 g/kg/day or more. This may require an additional 25 kcal/kg/day or more, in addition to an adequate "base" diet.

» For stunted, nonwasted children, height gain should be associated with some weight gain to maintain weight-for-height. This associated weight gain, comprising lean and fat tissue, should be taken into account when estimating energy and nutrient requirements of these children. It is not sufficient to provide them with only the additional nutrients needed for bone growth.

» There is evidence that growth deficits can be treated (i.e., that catch-up growth for height can occur) in children far beyond 2 years of age and even in adolescents, provided that a high-quality diet is sustained, though there is no evidence of similar recovery of other deficits associated with stunting, such as cognitive deficits. However, the prevention of stunting should always be directed at the window of opportunity from conception to the first 24 months of life, when most growth faltering occurs and impacts on health and brain development are greatest.

» Consumption of excess energy by wasted and stunted children, without the provision at the same time of all nutrients needed for an appropriate rate of lean tissue synthesis, will lead to the synthesis of excess fat tissue, with limited health benefits or even negative health effects.

» Currently, there is no evidence that rapid lean body mass growth of children under the age of 2 years has any serious negative long-term consequences.

» There is no physiological advantage in having more than 10% of energy derived from proteins to promote recovery of moderately wasted children. Higher protein intakes will increase renal solute load and may also have a negative effect on appetite. As a consequence, the participants concluded that it is not advised to use diets providing more than 15% of energy as protein in moderately wasted children.

» Catch-up in height is a less anabolically intense process than catch-up in weight, and correction of stunting requires less protein for tissue deposition than correction of wasting. However, as mentioned in the 2007 WHO report on protein requirements, having a protein intake higher than that needed for tissue deposition may have an additional positive effect on linear growth through a hormonal effect [4]. This possibility, however, is based on theoretical considerations and has not been verified in practice. Milk, unlike other protein sources, does appear to stimulate insulin-like growth factor 1 (IGF-1) secretion, but there is no clear information on the amount of milk that is needed to have this effect nor on its practical importance. On the other hand, high-protein diets increase renal solute load and, in the case of plant-based diets, are associated with high levels of antinutrients. For these reasons, the participants thought it is probably unnecessary to provide more than 12% of energy as protein and unadvisable to use diets providing more than 15% of energy as protein.

» Proteins used to feed moderately malnourished children should have a PDCAAS* of at least 70%. Giving

* PDCAAS (protein digestibility-corrected amino acid score) is a method of evaluating the protein quality based on the amino acid requirements of humans.

lower amounts of proteins with higher PDCAAS may be advantageous.

» The diets of children recovering from moderate wasting should provide at least 30% of their energy as fat. A higher percentage of energy derived from fat (35% to 45%) might have advantages, provided the density of nutrients is adequate.
» The participants recommended that diets for moderately malnourished children have at least 4.5% of their total energy content from n-6 polyunsaturated fatty acids (PUFAs) and 0.5% from n-3 PUFAs. The participants advised that the ratio of linoleic/α-linolenic acid should remain in the range of 5 to 15. A ratio within the range of 5 to 9, however, may be preferable.
» When large quantities of nutrients known to have an effect on acid–base metabolism are added to foods, their potential effect on the acid–base balance of the body after being absorbed and metabolized should be estimated. Their overall effect should remain neutral. Magnesium and calcium salts containing well-absorbed anions (such as chloride) should be avoided, as they may induce acidosis; organic magnesium and calcium salts, such as citrate, are preferable. Minerals added to the diet should preferentially be in a soluble form.
» The energy needs of moderately malnourished HIV-infected children are increased by 20% to 30% in comparison with those of non-HIV-infected children who are growing well. There is no evidence for increased protein requirements in relation to energy; i.e., 10% to 15% of the total energy intake is sufficient, as for non-HIV-infected children with moderate malnutrition
» Micronutrient intakes at the Food and Agriculture Organization (FAO)/WHO-recommended nutrient intake (RNI) levels need to be assured in HIV-infected children through consumption of diversified diets, fortified foods, and micronutrient supplements as needed. WHO recommendations for routine vitamin A supplementation (Integrated Management of Childhood Illness [IMCI]) and vitamin A supplementation in children who have signs of vitamin A deficiency and zinc supplements in children with diarrhea remain the same for HIV-infected children.
» As with children who are not HIV infected, when energy intake is increased, this should be matched by appropriately increased intakes of type I and type II nutrients.

Research needs

It is unclear whether a diet adequate for treating a moderately wasted child will also be adequate to treat a stunted child. It is possible, for example, that the stunted child will require a diet with a higher density of those nutrients specifically needed for cartilage formation and bone growth, such as sulfur and phosphorus. The length of time required for catch-up growth is also not known. Wasting may be corrected in a few weeks with an adequate diet, but the correction of stunting may take longer. There are data to suggest that children need to have an adequate weight-for-height before growing in height. Other data suggest, however, that children consuming a diet providing large quantities of all nutrients needed for linear growth may grow in length before reaching an adequate weight-for-height. Further studies are needed to clarify the effect of the diet on the timing of linear growth in relation to weight gain. This would be facilitated by the development of reliable techniques to measure length gain over short periods of times in the field.

Research is also needed on safe upper limits of different nutrients at different ages, as well as the requirements and importance of specific and often "forgotten" nutrients such as potassium, sulfur, phosphorus, and selenium. Some of these nutrients are not well recorded in international nutrition databases and hence may not be taken into account in calculations of dietary adequacy.

More field-friendly techniques (such as blood-spot technology) for assessing deficiencies of certain type I nutrients are needed. This will help build up knowledge of the prevalence of type I nutrient deficiency diseases. There is also a need for research on potential non-anthropometric outcome measures for assessing the efficacy of products and interventions for addressing moderate malnutrition.

Research is required to better understand the pathophysiology of how HIV causes undernutrition, how HIV-related undernutrition differs from undernutrition due to other causes, and how to distinguish between the different etiologies. Moreover, results from comparative studies of different nutritional interventions to treat children with HIV and undernutrition are needed.

Fundamental research is needed to obtain a better understanding of the pathophysiology of kwashiorkor. Currently, none of the proposed mechanisms for the development of kwashiorkor are supported by strong evidence that can be translated into preventive programming.

Foods and ingredients suitable for use in moderately malnourished children (Paper 2)

This background paper (prepared by Professor Kim Michaelsen and colleagues from the University of Copenhagen and Professor Tsinuel Girma from the University of Jimma, Ethiopia) provides an extensive description of foods and ingredients most commonly used to feed children with moderate malnutrition. It

highlights the special values of animal-source foods, which usually have a high content of type I and type II nutrients and are virtually free of antinutrients, thereby making the nutrients more bioavailable. Such foods also do not contain any dietary fiber. Moreover, dairy products can have a specific effect on growth through the stimulation of IGF-1 secretion. In addition to animal-source foods, vegetable fats are useful to provide adequate quantities of essential fatty acids.

Elaine Ferguson (London School of Hygiene and Tropical Medicine) presented a short paper explaining how linear programming can be used to check the nutritional adequacy (and assess the cost) of diets recommended for children with moderate malnutrition. Currently, there are various mathematical tools available, or under development, which determine whether it is possible to design a diet that is compatible with local feeding habits and provides all nutrients needed for growth. Linear programming can be used to design optimal diets that deviate as little as possible from current diets. Another approach is to use simulation techniques whereby software programs randomly generate thousands of diets complying with tentative feeding recommendations. The nutritional composition of these diets is then examined.

After the discussion and the working group sessions that followed the presentations, the participants agreed on the following points:

» The addition of animal-source foods to a plant-based diet promotes the recovery of moderately malnourished children. Diets providing substantial quantities of animal-source foods, including dairy products, provide high-quality protein and bioavailable micronutrients and have low levels of antinutrients and fiber.
» Diets based exclusively on plant foods need to be fortified and processed in such a way as to remove antinutrient contents to allow normal growth of well-nourished children under the age of 2 years. It may be also advantageous to reduce the level of dietary fiber, but this remains unproven.
» Diets with low antinutrient and fiber contents are beneficial for promoting the recovery of malnourished children.
» Processed fortified plant-based foods with a high PDCAAS, low levels of antinutrients, and low fiber content may also be used to treat moderately malnourished children, but this needs further testing.
» Phytate may seriously limit the efficacy of plant-based foods. The possibility of safely reducing phytate content by the use of phytase and/or food processing should be explored.
» Highly refined cereal flours (those with low extraction rates) have lower levels of antinutrients and dietary fiber than less refined flours. Highly refined flours cost more and have lower vitamin and mineral levels — although these vitamins and minerals are more bioavailable.
» Blended flours prepared with dehulled legumes are preferable to those prepared with whole legume flour.
» Food-processing techniques, including home-based processing techniques such as fermentation and soaking, can improve food quality, specifically nutrient bioavailability. The effect of antinutrients in complementary foods based on the family diet can be decreased by various traditional food-processing methods, such as malting or soaking. The feasibility and efficacy of these processing techniques for the management of moderate malnutrition should be assessed.
» The manufacturers should make available information about important antinutrients and the fiber content of the food produced to treat or prevent malnutrition in children.
» There may be some benefit in increasing the energy density of semisolid foods, such as porridges, to promote rapid weight gain of recovering malnourished children.
» The energy density of semisolid foods can be increased by reducing the water content or by adding fat or sugar. Adding fat and sugar, however, decreases the nutrient density in relation to energy and is acceptable only if the overall density of each and every essential nutrient is sustained at a level that supports normal balanced tissue synthesis.
» The increase in viscosity resulting from the reduced water content can be limited by using amylase or amylase-rich flours.
» Foods with a high energy density often have a high renal solute load and may not provide enough water for recovering children. Renal solute load is related to the protein and mineral contents of the diet. On the other hand, it is not related to dietary carbohydrate (including sugar) or fat content.
» Children fed diets with a high solute load in relation to their water content may need additional water during and between meals. Breastfeeding provides large quantities of water, in addition to a full range of nutrients. Breastmilk has a low solute load, and consumption of breastmilk rather than water should always be encouraged when energy-dense foods are provided.
» Because most diets in poor countries have a low level of n-3 (omega-3) fatty acids and an inappropriately high ratio of n-6 fatty acids to n-3 fatty acids, foods with high n-3 fatty acid contents should be promoted. These include soybean and rapeseed oil and fatty fish or its products. This is especially important for nonbreastfed children, since breastmilk usually provides large quantities of n-3 essential fatty acids. The essential fatty acid composition of breastmilk, however, is also dependent on the mother's intake of

essential fatty acids and may be low in case of insufficient maternal intake.
» The source and amount of fat used in processed foods for moderately malnourished children must be declared.
» The sodium level should be kept at a minimum in foods given to moderately malnourished children. It is not necessary to add salt to foods for moderately malnourished children.
» The iron content in fortified foods should be kept at levels needed to prevent iron deficiency. The goal is to achieve age-appropriate, adequate iron intake over the course of the day; no attempt should be made to add quantities of iron needed to treat iron-deficiency anemia to foods, especially in areas where malaria is prevalent or where kwashiorkor may occur.

Research needs

There is uncertainty about the minimum quantities or types of animal-source foods that are needed in the diets of children with moderate malnutrition. Milk and, potentially, eggs seem to have advantages over meat and fish in terms of growth but not in terms of improving micronutrient status. It is unclear whether children who are stunted but not wasted may benefit from different proportions of animal:plant protein in their diets, as compared with diets designed to treat wasting.

Research is also needed to assess whether dairy products, including whey, stimulate linear growth and/or reverse wasting in malnourished children in comparison with plant-based foods (e.g., soybeans) with high PDCAAS, low levels of antinutrients, and low fiber contents. The extent to which cooking or heat treatment denatures bioactive components of dairy products should also be investigated.

Data are needed on the maximum acceptable levels of intake of the most important antinutrients and of different types of fibers for children with moderate malnutrition. There is also a need to establish upper acceptable limits for sodium and iron contents of foods for children with moderate malnutrition.

Research is also needed on how to optimize the energy and nutrient density of foods while minimizing costs. There is also a need to establish whether high energy density of diets or the use of sweet supplements may cause acceptability problems in the short or the long term and run the risk of displacing the less energy-dense or less appetizing local diets.

More information on the importance of the quality of fat (i.e., optimal essential fatty acid and PUFA ratios) is required.

Dietary counseling for moderately malnourished children (Paper 3)

This background paper (prepared by Professor Ann Ashworth of the London School of Hygiene and Tropical Medicine) concluded that mothers of children with moderate malnutrition are usually given the same general dietary advice as mothers of well-nourished children. None of the programs reviewed gave guidance about quantities of nutrient-dense foods that are needed for the recovery of children with moderate malnutrition. The paper suggested that the generic dietary recommendations developed by WHO and FAO for well-nourished children may meet the requirements of children with moderate malnutrition if the recommendations are made more specific and context appropriate.

To date, there have been few studies of the efficacy of dietary counseling in treating moderate malnutrition. Studies looking at dietary counseling for moderate malnutrition report very different weight gains. Little information is available on other outcomes. Even height gains are rarely reported. Differences in reported weight gain are probably due to differences in initial nutritional status (stunted vs. wasted). It was noted that one of the most effective pilot nutrition counseling programs implemented in Bangladesh provided micronutrient supplements that may have increased its efficacy.

FAO has been developing materials for the use of local foods for feeding children during the complementary feeding period. These materials could be applicable in the context of moderate malnutrition. Their efficacy, however, has never been formally tested.

Save the Children US presented data showing that large-scale positive deviance programs in Vietnam and other countries have not had a significant impact on reducing moderate malnutrition.

After the discussion and the working group session that followed the presentations, the participants agreed on the following points:
» Dietary counseling, when done well, can be effective in preventing and managing moderate malnutrition. Prevention of linear growth retardation is best addressed prenatally and during the first 2 years of life.
» Dietary counseling for the prevention and management of malnutrition in general is often weak or absent and should be strengthened for all caregivers, especially those of children aged less than 24 months. Capacity-building of health care providers in dietary counseling is essential.
» Dietary counseling, breastfeeding counseling, and improving feeding practices should always be part of the management of moderate malnutrition. This is essential even when food supplements are given.
» Formative research should always be carried out

before formulating dietary recommendations. Only foods and feeding practices that are affordable, feasible, and acceptable to families should be recommended.

» Caregivers of children with moderate malnutrition need a reinforced approach for dietary counseling, including demonstrations, home visits, and/or group meetings. Dietary counseling for children with moderate malnutrition should specifically reinforce the quantity of nutrient- and energy-dense foods that are needed for recovery and promote age-appropriate feeding practices that are needed for recovery. Providing caregivers with standard nonquantitative recommendations designed for healthy children is likely to be insufficient.

» The nutritional adequacy of diets based on family foods should always be checked when planning strategies to treat children with moderate malnutrition. As a strict minimum, recommended diets should aim to provide all nutrients at the level currently recommended by FAO and WHO for healthy children, but a higher nutritional density would be preferable.

» Where prior assessment indicates that it is not possible to provide all nutrients needed by the child using the accessible family foods, other approaches, (including the use of fortified foods, food supplements, or micronutrient supplements) should be recommended.

» Feeding practices recommended for moderately malnourished children less than 2 years of age should be consistent with recommendations formulated in the PAHO/WHO "Guiding principles for complementary feeding of the breastfed child" [5] and the WHO "Guiding principles for feeding non-breastfed children 6–24 months of age" [6].

» The effect of antinutrients in complementary foods based on the family diet can be decreased by various traditional food-processing methods, such as fermentation, malting, and soaking. The feasibility of using these processing techniques to improve nutrient bioavailability in the management of moderate malnutrition should be assessed.

» Since infections, food insecurity, and poverty are closely linked with malnutrition, dietary counseling for moderate malnutrition should be integrated with primary health care, such as IMCI, and with community development programs.

» Dietary counseling as a means to provide essential knowledge and skills will contribute to sustained improvements in feeding practices, which can potentially prevent malnutrition and/or relapse.

» Comprehensive program design is essential and should consider mechanisms for capacity-building, effective monitoring, and supportive supervision.

Research needs

Research questions in this area include whether to always aim to maximize the rate of catch-up in wasted children and what are the most appropriate delivery channels for dietary counseling. Research into the effectiveness of a combination of approaches for addressing moderate malnutrition is also needed, e.g., infection control and nutritional support and the combined and separate impact of food supplements and dietary counseling.

In order to inform this research agenda, researchers need to report weight gain as grams per kilogram per day (as well as the percentage moving between different weight-for-height and height-for-age categories), disaggregate weight gain among wasted and nonwasted children, and broaden the number of outcomes (e.g., body composition, height gain, immune function, morbidity). Overall, we need a better understanding of how to provide and deliver effective dietary counseling.

Food supplements used to treat moderate malnutrition in children (Paper 4)

This background paper (prepared by Dr. Saskia de Pee and Dr. Martin Bloem, World Food Programme [WFP]) reviewed specialized food supplements that are currently used to treat children with moderate malnutrition in different contexts. This includes fortified blended foods prepared with cereals and legumes as major ingredients, complementary food supplements providing nutrients and energy missing in the family diet, and micronutrient powders.

Dr. de Pee and Dr. Bloem reiterated that most supplementary feeding programs for moderately malnourished children supply fortified blended foods, such as corn–soy blend and wheat–soy blend, in combination with oil and sugar, but that there are a number of shortcomings with fortified blended foods used for this purpose, including too high a content of antinutrients, particularly phytate; absence of milk, which is important for growth; suboptimal micronutrient content, even though the food is fortified; and high bulk and viscosity, which limits intake by young children. For these reasons, fortified blended foods are not optimal for feeding moderately malnourished, as well as young, children and need to be improved and/or replaced by foods that better meet the nutritional needs of these children.

Presentations from WFP, UNICEF, and the US Agency for International Development (USAID) described the various improvements the agencies all plan to make to their fortified blended flour products, e.g., increasing the energy density, adding dairy products, dehulling soybeans, possibly removing cereal germ, changing the proportion of energy from fat, and

improving the essential fatty acid and micronutrient profiles.

Improvements and adaptations to lipid-based nutrient supplements (LNS) and ready-to-use foods (RUFs) are also being made by the members of the LNS Research Network (supported by grants from the Bill and Melinda Gates Foundation and with support of the USAID-funded FANTA-2 Project) and Valid International.

Papers on field research from Malawi (Professor Ken Maleta, Blantyre College of Medicine), China (Professor Chen Chunming, International Life Science Institute), Niger and Sierra Leone (Dr. Susan Shepherd, Médecins sans Frontières–Nutrition Working Group), and Ghana (Professor Kathryn Dewey, University of California, Davis) presented data on the impact and outcomes of using specialized products to treat and prevent moderate malnutrition in different contexts. In Malawi, supplementary feeding of milk/peanut- and soy/peanut-fortified spreads to treat moderately wasted children resulted in slightly higher recovery rates than feeding with corn–soy blend. In Niger, a targeted Médecins sans Frontières supplementary feeding program for moderately wasted children using RUF had a 95% recovery rate. In Sierra Leone, the use of soy/peanut-fortified spread resulted in higher weight gain and shorter treatment than premix corn–soy blend/oil. In Ghana, children between 6 and 12 months of age who received a LNS had improved linear growth and were more likely to walk by 12 months of age as compared with control groups. In China, children receiving a soy-based micronutrient powder supplement from 4 to 24 months of age had improved linear and ponderal growth, reduced anemia prevalence, and improved IQ as compared with control group children. In Niger, the monthly incidence of low mid-upper-arm circumference (MUAC) decreased (compared with the incidence in the previous few years) after all children aged 6 to 36 months (blanket feeding) were given a LNS for 6 months during the hunger season.

After the discussion and the working group session that followed the presentations, the participants agreed on the following points:

» There is an urgent need to develop clear terminology for the different specialized foods used to treat moderate malnutrition. Classifications could be based on a number of variables: use of the product, e.g., ready-to-use bar or paste; purpose of the product, e.g., complementary food supplement; ingredients, e.g., LNS; and energy level, e.g., low, medium, or high.

» When it is expected that a new food product will have an impact on growth, morbidity, and micronutrient status at least equal to that of an existing product (often a fortified blended food such as corn–soy blend or wheat–soy blend), the participants suggested that it was then permissible to use this product in programs for feeding moderately malnourished children, provided that the product is acceptable to the beneficiaries. In that case, it is important to collect program data to monitor the impact of this new product on the time needed for recovery of children with moderate malnutrition if the product is used for treatment, or on the occurrence of new cases of malnutrition if it is used for prevention. Concurrently, the efficacy of the new product should also be assessed under carefully controlled circumstances in the same or another area or country, depending on local possibilities. Such efficacy testing should include measures of physiological, immunological, cognitive, and body compositional recovery as well as simple weight gain.

» Products that may be expected to have equal or better impact on growth, morbidity, and micronutrient status include those that have:
  — A nutrient density (in combination with the current diet of family food and breastmilk) consistent with current understanding of adequate nutrient intake for malnourished children;
  — Ingredients, fortificants, and hygiene criteria in accordance with Codex Alimentarius standards and guidelines suggesting that the product can be regarded as safe;
  — Production and packaging with appropriate quality control and quality assurance.

» It is very likely that different types of specialized foods and program formats (e.g., blanket or targeted dietary counseling) will be used to treat or prevent moderate malnutrition in the future, depending on the context (security, prevalence of malnutrition, general food security conditions, etc.). In some situations, blanket programs can also be regarded as treatment of a sick population, when there is evidence that nearly all children are underweight. The next WHO meeting on moderate malnutrition, which will focus on programming issues, should endeavor to develop algorithms for determining what program type and product to use in different situations.

Research needs

Areas of uncertainty still exist with respect to improving fortified blended foods. These include the impact of dehulling and degerming of soy, maize, and wheat; addition of phytase and/or amylase to improve nutrient availability and food acceptability; maximum tolerable fiber content; the minimal quantity of energy provided by fat to ensure adequate energy intake; the amount or proportion of milk required in the formula; and the possibility and efficacy of using plant protein isolates, especially soy protein isolates, as a possible substitute for dairy products. There is also a question regarding whether the antinutrient content of fortified blended foods can be significantly reduced by encouraging

farmers to produce crop types that have naturally lower concentrations of antinutrients. More fundamentally, the question was raised whether it is still appropriate to invest in improving fortified blended food products when so many other new and potentially superior products are becoming available. The costs of fortified blended food compared with different alternatives and the use and purpose of the product, as well as the programming and opportunity costs of the different options, should be taken into account before answering this question.

Agencies urgently need to collect impact assessment data from the different products (fortified blended food, RUF, LNS, and micronutrient powders) being used to treat and prevent moderate malnutrition in different contexts so that field agencies and governments know which product to use in a given context. Often, these terms (fortified blended food, RUF, LNS, micronutrient powders) are used for products with significant variability in ingredients and manufacturing processes. For example, USAID, WFP, and UNICEF each have different specifications for fortified blended food, often under the same generic term of corn–soy blend, yielding products with different nutritional composition and fiber content. For this reason, it is suggested that leading organizations collaborate to develop standard specification(s) for these products or utilize different names for products produced under different specifications. Nongovernmental organizations (NGOs) or researchers collecting data on the effectiveness of fortified blended foods should indicate the source of the product (e.g., USAID, WFP, UNICEF) and the manufacturer (if available).

The impact and outcome data need to be comparable across studies and program evaluation. Information on nonfood context factors (e.g., program incentives) should also be collected. The operational advantages of some products or program types should be recorded (e.g., blanket distributions may be easier in food-insecure areas). Much of the work on the treatment of moderate malnutrition with new products has taken place in sub-Saharan Africa. There is a need to assess how applicable the research findings are to children with moderate malnutrition in Asia and other parts of the world.

It is essential to collect information on the costs of providing different types of specialized products, complementary interventions, and the means of distribution. Ultimately, if all children with moderate malnutrition are to be treated (i.e., not just those with moderate malnutrition due to emergencies), there is a need to consider what national governments and development agencies can afford.

Recommendations of the meeting: Next steps

In addition to endorsing the technical consensus statements and identified research needs mentioned in different sections of this report, the participants made recommendations to move forward and to continue to improve current programs in the next few years.

1. Establishment of a process to develop specifications for food categories for moderately malnourished children and validation of new products for prevention and treatment of moderate malnutrition in children

As an introduction to this discussion, a representative from FAO, Dr. Jeronimas Maskeliunas from the Codex Alimentarius secretariat, gave a presentation on the objectives of the Codex Alimentarius, its modus operandi, and its publications that are relevant to moderate malnutrition in children. The objectives include "to promote coordination of all food standards by international NGOs and Governments and to produce and amend standards, Codes of Practice, Guidelines and other documents."

Also, Dr. Carlos Navarro-Colorado, representing the Emergency Nutrition Network, presented a description of a generic approach to validate the efficacy of new foods for moderate malnutrition. This would need to be based upon clear classification of different types of food supplements required and the nutrient specifications for each category of food supplement. Four stages of validation were proposed: analysis of composition and processing, small-scale clinical pilot, field efficacy trial, and postvalidation monitoring. It will not be necessary to conduct all four stages for all products.

The design of studies and validation of products will face a number of challenges. These include lack of baseline dietary information, accounting for differences in the quality of program implementation, the need to broaden and define outcome indicators beyond anthropometry, and accounting for the fact that an unknown proportion of moderately malnourished children will recover spontaneously. Another significant challenge will be how to establish an institutional mechanism and identify a lead agency for ensuring coordinated validation of products.

A working group then examined how to move forward and how to set up a process of improving existing food supplements and ensure their efficacy is adequately evaluated. The group made the following statements, which were reviewed and approved in the final plenary session:

» Moderate malnutrition is a pathological process that requires special dietary treatment. There is a need to develop specific recommendations for adequate dietary intakes of energy and all nutrients for different categories of children with moderate malnutrition

(stunted and wasted).

» A standing task force should be established and led by WHO with appropriate UN agencies and other technical experts to develop specifications for specialized products, in particular for moderately wasted children in a first step. In view of the uncertainties about the nature of diets needed by stunted children, this task force should provide guidance for testing new products. This task force should work in collaboration with the Codex Alimentarius working group.
» A separate expert group should be established, also in collaboration with the Codex Alimentarius, to examine different endogenous food components that have potential negative effects and develop upper limits for these antinutrients and toxins. One of the tasks of this group would be to determine the maximum acceptable level of different types of dietary fibers and other potentially deleterious natural constituents that can be present in food supplements.
» There is a need for an independent standing working group to assist national governments and agencies to determine if newly available products that are put onto the market are appropriate and whether (a) particular type(s) of product testing are required before granting approval for their use among specific target groups.
» The meeting recommended that this set of activities should be initiated within the next 6 months.

Research needs

In the discussions, the meeting also identified the need to estimate the level at which recovery from moderate malnutrition occurs in the absence of supplementation, so that this can be accounted for in trials involving new products. This can be achieved either by examining data from previous studies in which some children did not receive any supplement or by taking as a control group in intervention studies a group receiving adequate dietary counseling but no food supplement. The latter option, however, will be acceptable only in a context of good food security, where families have access to nutrient-dense foods.

There is also a need to elaborate specific nonanthropometric measures that can be used to compare outcomes and product efficacy. This will involve developing and strengthening field-friendly techniques for measuring outcomes, such as body composition immunocompetence, micronutrient status, renal concentrating ability, physical activity level, sodium pump function, intellectual development, etc.

2. Organization of a second meeting on improving programs addressing the management of moderate malnutrition

The focus of this technical meeting was dietary requirements of children with moderate malnutrition, so that programmatic issues were not substantively addressed. WHO is planning a further technical meeting on programming for children with moderate malnutrition. The participants supported this initiative, and during the penultimate session a plenary debate regarding a possible agenda for this second meeting was organized. Although there was broad consensus regarding key subject areas for the agenda, there was some debate over whether the meeting should focus on wasting and prevention of stunting and omit treatment of stunting due to current knowledge and resources gaps. This issue will be resolved in the coming months. There was also unresolved debate over the extent to which HIV/AIDS should form part of the meeting agenda.

Agenda issues where there was broad agreement were clarification of program selection and exit criteria for children with moderate malnutrition and relevant indicators; developing a program typology, taking into account the program context, describing the situation where targeted and blanket food distribution should be implemented, and learning from experiences gained in the community management of severe acute malnutrition, especially with regard to integration of programs into government systems; and identifying target age groups for treatment. There is a need also to assess costs and effectiveness of different programming modalities and broadening modalities for addressing moderate malnutrition to include cash or voucher-type interventions. The meeting should also tackle issues related to monitoring and evaluation, as well as review emerging knowledge regarding barriers to access and utilization of programs, default from programs, and nonresponse to supplementation.

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