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## WHO/UNICEF Review on Complementary Feeding and Suggestions for Future Research: WHO/UNICEF Guidelines on Complementary Feeding

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#### Introduction

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The objectives of this presentation are to:

- 1 describe briefly the scope and limitations of the recent WHO/UNICEF review of scientific knowledge on complementary feeding of young children in developing countries<sup>1</sup>
- 2 review selected conclusions of that document and related recommendations for future research

#### General Comments

Before presenting the specific research recommendations, it is worthwhile to note several general issues concerning the WHO/UNICEF review document. First, it must be recognized that this publication was targeted to those aspects of complementary feeding that are particularly relevant for low-income countries. Most infants in these settings are breastfed; and, in general, suitable, low-cost alternatives to breastfeeding are not available. Therefore, no information was provided on feeding non-breastfed infants. Second, because the physiologic and behavioral development and nutritional requirements of infants are in flux, recommendations were prepared for specific categories of infant age. Third, the information included in the report was intentionally directed to a global audience. The document emphasized the need for local adaptation of the conclusions of the report, according to available foods, prevailing feeding practices, economic constraints, and dominant cultural beliefs in particular countries. It was recognized that this local adaptation will require, in some cases, further research on current child feeding practices and the factors that influence them before specific programmatic interventions to improve these practices can be put into place. Finally, the WHO/UNICEF review was oriented to the nutritional needs of generally healthy infants and young children. No information was included on

feeding premature infants or children with infections or other acute or chronic diseases that might affect their nutritional status.

### **Selected Conclusions of the WHO/UNICEF Report and Recommendations for Research**

**Age of Introduction of Complementary Foods** The optimal age of introduction of complementary foods remains controversial. The appropriate time may represent a compromise between 2 competing health issues. On one hand, if complementary foods are introduced too late—when breast milk alone no longer meets all the infant's energy and nutrient needs—nutrient deficiencies and growth faltering may occur. On the other hand, because these foods are often contaminated with microbial pathogens, premature introduction carries an unnecessary risk of transmission of infection. A sizeable number of observational studies<sup>1</sup> and 2 randomized trials<sup>2,3</sup> have failed to identify any benefit of complementary foods for infant growth before 6 months of age, even in low birth weight term infants. By contrast, several studies have documented a twofold or greater risk of enteric and other infections when these foods are provided before 6 months.<sup>4,5</sup> Hence, the authors of the WHO/UNICEF report concluded that the optimal age of introduction of complementary foods is about 6 months. Nevertheless, additional information from randomized intervention trials in different parts of the world would be desirable to resolve any remaining controversy surrounding this topic.

### **Research Topic**

Information is needed on the appropriate age of introduction of complementary foods and optimal duration of breastfeeding, from the dual perspectives of both infant outcomes (growth, behavioral development, micronutrient status, and the risks of infection, allergy, and impaired intestinal function) and maternal outcomes (general health, nutritional status, and return to fertility). Ideally, information should be collected in the context of randomized intervention trials, where possible.

**Energy Required From Complementary Foods** Estimates of the amount of energy required from complementary foods can be calculated as the difference between the total recommended energy intake and energy consumed from breast milk at different ages. In the WHO/UNICEF review, information on energy consumption from breast milk was compiled from 21 published studies conducted in developing countries.<sup>1</sup> Weighted mean energy intakes from breast milk reported from these studies were 413, 379, and 346 kcal/d by children 6 to 8, 9 to 11, and 12 to 23 months of age, respectively. Current estimates of children's average energy needs are 682, 830, and 1092 kcal/d for these same age groups.<sup>6,7</sup> Thus, the average amounts of energy required from complementary foods are approximately 275, 450, and 750 kcal/d during these age intervals.

To ensure that children are able to consume the desired amount of energy from complementary foods, these foods must be prepared with a minimally adequate energy density and served an appropriate number of times each day. Clinical studies of the effects of different frequencies of feeding and composition of meals on total daily energy intakes by fully weaned children indicated that both energy density and meal frequency independently affected the children's total daily energy intake.<sup>8</sup> The results from these and other studies of the amounts of food consumed by young children at single meals were used to develop tentative guidelines on the minimum energy density needed to enable them to satisfy

their theoretical daily energy requirements, assuming different numbers of meals per day. However, these estimates must be viewed with caution because the former studies were conducted in fully weaned children; similar studies have not yet been completed in breastfed infants. Recommendations regarding the energy density and frequency of feeding of complementary foods must take into consideration their potentially adverse effects on breast milk intake.

### Research Topic

Additional studies of the effects of different complementary feeding practices on both total daily energy intakes and intakes of breast milk are urgently needed. Studies should consider not only the effects of energy density and feeding frequency of complementary foods, but also the possible roles of the macronutrient content (total lipids and essential fatty acids, simple sugars and complex carbohydrates, protein content, and composition) and organoleptic properties (texture, flavor, aroma, etc) of these foods, the mode of feeding (hand, spoon, bottle), and the order of feeding of these foods and breast milk. Additional information is also needed on "functional gastric capacity" (ie, the amount of food that can be consumed at a single meal) of children of different ages consuming various types of foods.

**Nutrient Content of Complementary Foods** In the WHO/UNICEF review the desirable macro- and micronutrient contents of complementary foods were estimated using the same conceptual framework as described for energy. Specifically, figures for the nutrient contents of breast milk at different postpartum periods were subtracted from the theoretical nutrient requirements of children of these ages; the difference was assumed to represent the average amounts of these nutrients that must be provided by complementary foods. The amounts of nutrients required from complementary foods were further estimated for low, average, and high consumers of breast milk. However, because it is difficult to measure the amount of milk consumed by an individual child, the report further suggested that complementary foods could be assessed in terms of their nutrient densities. In other words, by dividing the total amount of individual nutrients required from complementary foods by the amount of energy needed from those foods, the desirable nutrient density (per unit energy) can be calculated. It is important to realize that the desirable nutrient density of complementary foods for some nutrients is greater when breast milk consumption is low, but for other nutrients is greater when breast milk consumption is high. For example, because breast milk is a rich source of vitamin C, the more breast milk that is consumed the lower is the recommended nutrient density of complementary foods with respect to this vitamin. By contrast, because breast milk is a poor source of zinc for older infants, the more milk that is consumed the greater is the recommended nutrient density of complementary foods for zinc.

Comparison of the theoretically desirable nutrient densities with the actual nutrient densities of different foods and mixed diets from selected countries identified a subset of so-called "problem nutrients," which were difficult to supply from diets commonly offered to young children in low-income countries. In particular, iron, zinc, and calcium were unlikely to be present in complementary foods in adequate amounts unless either a large proportion of the diet were derived from animal products or the foods were fortified with these problem nutrients.

### Research Topic

Research is needed on the best ways of assuring that children can satisfy their micronutrient requirements during the period of complementary feeding, especially for those problem nutrients that are difficult to provide from the typical complementary foods that are available in low-income situations. Possible approaches, such as dietary modification (through provision of specific nutrient-rich foods or novel forms of food processing to enhance the bioavailability of nutrients from those foods), fortification, or supplementation, should be evaluated through both qualitative research on their acceptability and quantitative studies of nutrient bioavailability and the impact of these intervention on young children's nutritional status.

**Other Topics Considered in the WHO/UNICEF Review** Other topics that were considered in the WHO/UNICEF review included food safety (microbiologic and chemical) and food processing, child feeding behaviors and general issues of child care, and intervention programs to improve complementary feeding practices. Detailed review of these topics is beyond the scope of the present summary, although some of these issues will be discussed by other participants in the conference.

## ► REFERENCES

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