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Recommendations for the complementary feeding of the breastfed child

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Abstract

Objective: To present a review on the evidences that support the current recommendations for breastfed children feeding.

Sources of data: An extensive bibliographic review of the topic was carried out. Articles selected in the MEDLINE and Lilacs databases, publications from national and international organizations, theses and dissertations were reviewed. Some key articles were also selected from the citations referred in other papers.

Summary of the findings: New knowledge acquired about child feeding over the last 20 years have led to a significant change in the current feeding recommendations for breastfed children in relation to the prior recommendations. The current recommended nutritional needs are lower than the old recommendations, complementary food is introduced in a more precise age, around 6 months, and new methods are recommended for promoting the child's healthy eating. The new recommendations emphasize the health feeding practices which comprise both the adequate food quantity and quality, including care with food handling and preparation, feeding and storage practices, and the respect and adequacy to the cultural characteristics of each people.

Conclusions: The adequate complementary feeding of the breastfed child is critical for the optimal child growth and development. Therefore, it is an essential factor for both the populations' food security and the development of nations. The health professionals are ought to effectively pass on to mothers/care takers the new recommendations for promoting the healthy complementary feeding of the breastfed child. It is up to the governments to provide the adequate conditions for supporting such a promotion.

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Infant feeding from birth up to the first years of life influences an individual's whole life. It is common knowledge that breastfeeding is important for optimal infant feeding. Breastmilk alone can be used to properly feed infants in the first six months of life, but from then on, complementary feeding is necessary. The nutritional adequacy of complementary foods is essential to the prevention of infant morbidity and mortality, including malnutrition and overweight.[1] The linear growth retardation acquired early on in infancy cannot be easily reversed after the second year of life.[2] In this context, providing infants with optimal feeding should be the key objective of a global strategy to guarantee the nutrition safety of a population. Although health professionals are in charge of promoting it and mothers are responsible for putting it into practice, the final success of this action also depends on the definition of appropriate governmental policies[3] and on the participation and support of civil society as a whole.[4]

In the last few years, some important advances in breastfeeding promotion have been made, but unfortunately, the same does not apply to complementary feeding.[5,6] New information about infant feeding acquired in the last 20 years has made obsolete several concepts and recommendations that had been common in pediatric practice for a long time. However, part of the population, including health professionals, does not know of the scientific advances in this field.[5,6] The current article reviews the pieces of evidence that support the current recommendations for the complementary feeding of

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Brazilian breastfed infants, thus contributing to the promotion of their healthy nutrition.

Definitions

Complementary feeding is giving infants other foods or fluids than breastmilk. Complementary food is any food other than breastmilk given in the complementary feeding period.[5] Complementary foods can be especially prepared for the infant or can be the same foods available for family members, modified in order to meet the eating skills and needs of the infant. In the first case, they are called transitional foods, and in the second case, there is no specific nomenclature.[5] The terms related to infant feeding used in the present article are those currently recommended by the World Health Organization (WHO) and internationally adopted,[5,6] including in Brazil.[7] The terms "weaning foods" and "supplementary feeding", widely used for a long time, are not recommended as synonyms for complementary feeding, since their use is incorrect,[8] giving the impression that foods are introduced to replace breastmilk, instead of complementing it.[7,9] The use of the term "weaning" is not advisable, since in many countries,[3] including Brazil, it may be understood as total cessation of breastfeeding,[6,7] and cause problems in breastfeeding promotion. The term "weaning" was used to indicate the transition between exclusive breastfeeding and the cessation of breastfeeding. Nowadays, the term "full weaning" is used to indicate the total cessation of breastfeeding.[5]

Timely introduction of complementary foods

Optimal duration of exclusive breastfeeding

Doubts and controversies about the proper duration of exclusive breastfeeding, raised in the late 1970s and expressed in the so-called "weaning dilemma,"[10] persisted up to 2001 when, after the 54th World Health Assembly, WHO recommended the introduction of complementary foods around the sixth month of life, instead of between the fourth and sixth month, as previously recommended, and incorporated this change in its recommendation for global public health.[11] The decision followed the publication of a report that discussed the evidence regarding the optimal duration of exclusive breastfeeding.[12-14] Nevertheless, only in 2002[13] a world consensus was reached establishing that there is no benefit that outweighs the risks and disadvantages of the early introduction of complementary foods before 180 days of life.[6] In the population, infants exclusively breastfed up to six months are less affected by diarrhea and do not have growth deficits, both in industrialized and in developing countries.[5] Exclusive breastfeeding up to the sixth month of life has been recommended by the Brazilian government since the early 1980s.[15]

It is only after the sixth month of life that the nutritional requirements of infants cannot be provided only via breastmilk.[5] From this age on, most infants reach a general and neurological stage of development (chewing, swallowing, digestion and excretion) that enables them to be fed other foods rather than breastmilk.[5,16,17]

Disadvantages of early or late complementary feeding

Several studies carried out in developing countries, including Brazil, and in industrialized countries showed that the early introduction of complementary foods increases infant morbidity and mortality, as a result of the reduced ingestion of protective factors present in breastmilk, in addition to the fact that complementary foods are an important source of contamination for infants.[18]

From the nutritional viewpoint, the early introduction of complementary foods can bring some disadvantages, since these foods, in addition to replacing part of breastmilk, even when breastfeeding frequency is maintained,[19] often have a lower nutritional value than breastmilk,[5] for instance, foods that are extremely diluted. A shorter duration of exclusive breastfeeding does not protect infant growth so well as exclusive breastfeeding for six months does,[5,20] and neither does it improve it.[21,22] After the sixth month, the replacement of breastmilk with complementary foods is less problematic.[5,6]

Moreover, the early introduction of complementary foods shortens the duration of breastfeeding,[23] interferes with the uptake of important nutrients found in breastmilk, such as iron[24] and zinc,[25] and reduces the efficiency of lactation in preventing new pregnancies.[26]

More recently, the early introduction of complementary foods has been associated with the development of atopic diseases. Exclusive breastfeeding minimizes the risk of asthma and this protective effect seems to persist for at least during the first decade of life, which is particularly evident in children with a family history of atopic diseases.[27] Exclusive breastfeeding also seems to protect against the development of type 1 diabetes mellitus. It has been described that early exposure to cow's milk (before the fourth month) can be an important determinant factor for this disease and that it can increase the risk for diabetes by 50%. It is estimated that 30% of the cases of type 1 diabetes mellitus could be avoided if 90% of the infants aged up to three months were not fed cow's milk.[28]

In some countries, there is a recommendation to only introduce some specific foods, considered highly allergenic, after the second year of life. Cow's milk (responsible for 20% of food allergies) ranks on the top of the list, being not recommended before 9-12 months. In case of important family history of food allergy, it is recommended that foods such as eggs, peanuts, nuts and fish not be given in the first year of life. There is a recommendation that honey should be avoided in infants younger than 12 months in order to prevent botulism.[29]

When infants exclusively breastfed for six months do not develop properly, before considering the introduction of complementary foods, a careful assessment should be made to verify whether they are not ingesting too little

breastmilk due to a poor breastfeeding technique, which leads to improper emptying of the breasts and, consequently, to a low milk production. In these cases, the usual recommendation is that mothers receive instructions and support so that the baby can increase the intake of breastmilk and complementary feeding is not introduced unnecessarily.[30] One should recall that the current growth curves are predominantly based on infants fed industrialized milk[31] and that the growth of healthy breastfed infants aged between three and nine months often is smaller than that of nonbreastfed infants.[32] This, however, does not imply any functional disadvantage.[33] WHO has recently coordinated a multicenter study in selected countries, including Brazil, to follow up the growth of infants exclusively breastfed for at least four months and receiving complementary breastfeeding for at least 12 months. The results of this study will be used to develop a new growth curve, which will be recommended by WHO and will replace the current NCHS reference.[34]

The late introduction of complementary foods also is disadvantageous, because infant growth stops or slows down and the risk of malnutrition and micronutrient deficiency increases.[5,6]

Characteristics of proper complementary feeding

A proper complementary feeding consists of foods that are rich in energy and in micronutrients (especially iron, zinc, calcium, vitamin A, vitamin C and folates), free of contamination (pathogens, toxins or harmful chemicals), without much salt or spices, easy to eat and easily accepted by the infant, in an appropriate amount, easy to prepare from family foods, and at a cost that is acceptable by most families.[35]

Energy content

Estimations of total energy requirements and of the amount of energy to be provided by complementary foods have been based upon theoretical data and are subjected to restrictions due to methodological peculiarities of studies involving infants younger than two years. Because of that, these estimates have been constantly revised. Some experts pointed out that the energy estimates presented in WHO recommendations (1998)[6] were overestimated.[6,36-39] Therefore, every new evidence provided since 1998,[36] and also the previous recommendations were revised[5] in order to obtain the current WHO recommendations.[3,6]

The current estimations of total energy requirement for infants younger than two years are based on data from a cross-sectional study with U.S. infants, and are stratified according to the age of the infant, type of feeding (breastfed and nonbreastfed) and gender. Total energy expenditure, body mass and body composition were considered for this analysis. The data were sex-matched and, to facilitate comparison, they were classified using the same age groups employed in the previous recommendations.[36]

The current total energy requirement estimated for healthy breastfed infants is of approximately 615 kcal/day from 6 to 8 months of life, 686 kcal/day from 9 to 11 months and 894 kcal/day from 12 to 23 months.[3,36] With regard to the previous recommendation, these values are nearly 5 to 18% lower than the requirements expressed in days and nearly 5 to 13% lower when expressed as body weight.[36] No modification to the estimates of energy transferred from breastmilk were made.[3,5,6,36] Unlike the previous recommendation,[5] malnourished infants (whose requirements are higher) were excluded and only the requirements of breastfed infants were considered, which allowed obtaining more appropriate energy estimates for healthy and breastfed infants. In the future, it could be interesting to investigate non-US infants for energy requirement estimations in order to deal with possible geographical differences.[36]

At present, the energy estimates to be provided by complementary foods are approximately 25 to 32% lower than the previous estimates.[36] For infants younger than two years living in developing countries, with an average breastmilk intake for each age, complementary foods are believed to provide approximately 200 kcal a day from 6 to 8 months of life, 300 kcal from 9 to 11 months and 550 kcal from 12 to 23 months. These estimates are different for industrialized countries due to some discrepancies in the average intake of breastmilk and in its fat content, amounting to 130, 310 and 580 kcal a day, respectively.[6]

Infants self-regulate their daily intake of energy in a very efficient way. Thus, they tend to eat smaller amounts of energy-rich foods,[40] although infants eating a high-energy diet (number of calories per unit of volume or weight) tend to have a higher daily intake of energy.[41] The reduced stomach size (30-40 ml/kg) of infants may prevent them from meeting their energy requirements if they are eating a low-energy diet. On the other hand, if infants get an excessive amount of energy from complementary foods, they can reduce the intake of breastmilk, but this is not recommended, especially for younger infants.

Therefore, the recommended energy intake of complementary foods varies according to the age of the infants, and depends on how much breastmilk they ingest, on the fat content in breastmilk, and on the frequency at which they are fed complementary foods. For infants with an average breastmilk intake and who eat at least three meals a day containing complementary foods, the recommended energy intake ranges from 0.6 kcal/g at 6-8 months of life to 1 kcal/g at 12-23 months. When breastmilk intake is lower or the infants have a growth delay, energy intake should be higher, ranging from 0.8 to 1.2 kcal/g.[5]

Brazilian infants younger than two years usually ingest appropriate amounts of calories, although the energy intake may be low in each meal, which can be a result of the type of food eaten and of its consistency. Soft and diluted foods, which have a low energy content, are frequently eaten by Brazilian infants.[42]

Protein content

The recommended protein content (grams of protein per 100 kcal of food) for complementary foods is of 0.7 g/100 kcal, from 5 to 24 months.[7] In most countries, the protein requirements of infants are met when the energy intake is appropriate, except if there is a predominant intake of low-protein foods (e.g.: sweet potato and cassava).[5]

It is of paramount importance that infants eat high-quality and easily digestible proteins, which are found in breastmilk and in animal products. Alternatively, high-quality protein can be provided by properly mixing some vegetables or cereals (ex.: rice and beans).[43]

Fat content

Lipids in complementary foods should provide approximately 30 to 45% of the total energy required,[36,44] which is enough to guarantee the adequate intake of essential fatty acids, good energy intake and uptake of fat-soluble vitamins.[6] Fat in the diet affects the general intake of nutrients[5] and, if excessive, may exacerbate micronutrient malnutrition in vulnerable populations.[6] Anecdotal evidence suggests that excessive fat intake predisposes to childhood obesity and cardiovascular diseases.[45]

Mineral content

To meet the nutritional mineral requirements of infants, a variety of mineral-rich complementary foods should be offered, since the consumption of these foods is relatively small among infants/children aged between 6 and 24 months.[5] From 9 to 11 months of life, the amount of minerals that should be provided by complementary foods is high: 97% for iron, 86% for zinc, 81% for phosphorus, 76% for magnesium, 73% for sodium and 72% for calcium.[36]

Iron

The recommended iron intake is of 4 mg/100 kcal from 6 to 8 months, 2.4 mg/100 kcal from 9 to 11 months and 0.8 mg/100 kcal from 12 to 24 months. In developing countries, due to low iron intake and bioavailability (only approximately 11 to 18% of uptake), iron requirements often cannot be totally met.[5,46,47] Infants aged between six and 12 months cannot eat enough iron-rich foods to meet their requirements,[5,48] in addition to the fact that the price of these foods can be prohibitive to low-income families.[5,49,50] The availability of iron-fortified foods is larger in industrialized countries than in developing countries.[5,50] This is why iron-deficiency anemia is highly frequent among infants younger than two years in Brazil.[7]

Foods of animal origin have a better iron bioavailability (up to 22% of uptake) than those of vegetable origin (1 to 6%). Meats (especially red meat) and some animal organs (mainly liver) have some advantage over milk and its derivatives due to their iron content and bioavailability. Some foods contain reasonable iron content, but low bioavailability. This is the case of egg yolk, beans, lentils, soybean and dark green vegetables (Swiss chard, kale, broccoli, white mustard, wild chicory). The iron uptake in foods of vegetable origin can be enhanced if some foods such as meat, fish, fructose and ascorbic acid (orange, guava, lemon, mango, papaya, melon, banana, passion fruit, peach, tomato, capsicum, green leaves, cabbage, broccoli, cauliflower) are offered in the same meal. In this case, raw and fresh foods should be preferred, as vitamin C is destroyed during cooking.[5] On the other hand, eggs, milk, tea, mate or coffee hamper iron uptake, since they form insoluble precipitates with iron. The inhibitory effect of whole cereals (rice, corn, wheat) is due to the presence of phytates and not of fibers, which do not have an inhibitory effect. Milk inhibits the uptake of heme and nonheme iron due to its calcium content and probably due to the presence of phosphoproteins. The high intake of cow's milk contributes to the high prevalence of childhood anemia. In a cohort of European infants at 12 months of life, hemoglobin level decreased by 0.2 g/dl to each additional month in which nonfortified cow's milk was ingested.[51] In São Paulo, Brazil, the risk for anemia is 2.2 times higher in infants/children aged between six and 59 months with a higher milk intake than those with a lower milk intake.[52]

Vitamin content

Vitamin A

If the mother's diet has an adequate vitamin A content, the offer of vitamin A-rich foods easily meets the requirements of the nursing infant. If the mother lives in a vitamin A deficiency endemic area, she should receive special supplementation[53,54] and her infant should be offered vitamin A-rich foods,[55] preferably some time before or after breastfeeding in order to increase the uptake of carotene and retinol from the diet.[5] The major food sources of vitamin A are liver, egg yolk, milk products, dark green and leafy vegetables and yellow/orange vegetables and fruit (carrots, pumpkin, red peppers, yellow peppers, mango, passion fruit and papaya).

Vitamin D

Breastmilk and complementary foods have very little to contribute to the supply of vitamin D requirements, since this vitamin basically depends upon direct exposure of the skin to sunlight. Its dietary intake is only important in case of inappropriate endogenous production or depletion of body stores. In exclusively breastfed babies unexposed to sunlight, vitamin D stores present at birth would probably become depleted within eight weeks.[56] However, a few hours of sunlight exposure in the summer – 0.5 to 2 hours a week (17 minutes a day) with exposure of the baby's face and hands only, and 30 minutes a week (4 minutes a day) if the baby is wearing nothing but diapers[57] – produces enough vitamin D to avoid deficiency for several months.[58,59] Dark-skinned infants require three to six times more exposure than fair-skinned babies to produce the same amount of vitamin D.[58-60]

Other vitamins

The supply of vitamins such as riboflavin, niacin, thiamin, folate, vitamin C and vitamin E may be low in some populations, but further evidence is necessary before specific recommendations are made available.[3]

Selection of complementary foods

The infant can be fed family foods, provided that consistency and energy content are appropriate. Food preparations that do not meet the minimum energy requirements (e.g.: soups, oatmeals and overly diluted milks) should be avoided.[5]

From the eighth month onwards, foods should vary and balanced mixtures containing cereals, tubercles, foods of animal and vegetable origin, and fat should be offered.[35] Only a varied diet guarantees the supply of micronutrients, enhances good eating habits and prevents the development of anorexia caused by monotonous foods.[5] Infants, and adults later on, tend to prefer the foods the way they were initially introduced. Therefore, infants should be initially offered foods containing low sugar and salt contents.[35]

It is important to guarantee the offer, every day if possible, of foods of animal origin rich in iron and of fruit and vegetables, especially those rich in vitamin A.[5,37,56] Nonfortified or nonsupplemented vegetarian diets are not recommend for infants younger than two years because they do not meet the requirements of some nutrients, such as iron, zinc and calcium.[5,6,36,48]

It is not advisable to give infants younger than one year unmodified cow's milk, especially if raw and undiluted, because its use is associated with blood loss in the stools and iron deficiency.[61-64] Avoid offering sugary beverages (soft drinks and others), as they reduce the infant's appetite for more nutritious foods and may soften the stools.[6] Tea and coffee are also unadvisable because they may interfere with iron uptake.[5,6]

The American Academy of Pediatrics recommends a maximum of 240 ml/day of fruit juices, to avoid competition with nutritionally richer foods.[6] Association between excessive intake of fruit juices and failure to thrive[64] short stature and obesity[65] has been reported, but further studies are necessary in order to confirm these findings.[66]

To guide mothers/caregivers in the selection of complementary foods, health professionals must know the nutritional value of local foods, and their use in infant feeding.[5,7,35] If necessary, local food composition tables should be referred to.[6]

How to introduce complementary foods

The recommendation is that new foods be gradually introduced, one at a time, every three to seven days. It is common for infants to reject new foods, but this should not be interpreted as permanent aversion to that food. On average, infants need to be exposed to a new food eight to 10 times until they accept it well.[67,68] Breastfed infants tend to accept new foods more easily than nonbreastfed ones, because via the breastmilk, they are exposed to different flavors and scents very early on, which vary according to the maternal diet. Thus, infants are introduced to the family eating habits from the moment of birth (probably during the intrauterine life too).[69] Improper food consistency compromises the appropriate intake of nutrients by the infant.[6] Therefore, at the beginning of complementary feeding, the foods should be especially prepared for the infant. The foods should be initially semi-solid and soft (in the form of a puree), and should be crushed, never sifted or blenderized. Soups and soft foods do not provide enough calories to meet energy requirements of infants and are therefore not recommended. Food consistency should be gradually improved, considering the infant's eating skills.[5] At eight months, the infant can be offered family foods, provided that they are crushed, shredded, chopped or cut into small pieces. At 10 months, the infant can eat grain foods, otherwise, he/she will be at greater risk for eating disorders at 15 months.[70] At 12 months, most infants can eat the same foods their family eats, provided that these foods have an appropriate energy content and consistency.[36] After that, the offer of semi-solid foods should be restricted, and sharp foods and/or foods with a hard consistency should be avoided (e.g.: raw carrots, nuts, grapes), as they can make infants choke.[35]

Complementary foods should be given using a spoon or glass,[6,7] which are well accepted by infants. Baby bottles should be avoided because, in addition to being an important source of contamination for the infant, they interfere with oral dynamics[71] and may cause "nipple confusion,"[72] especially during the establishment of breastfeeding, exposing the infant to a greater risk of early weaning.[73,74] One should recall that the use of baby bottles is not necessary during the baby's growth.[35]

Complementary foods can be offered either before or after breastfeeding.[5,75]

In some populations, infants are encouraged to eat only when they are sick or when they refuse to eat.[76-78] In other populations (e.g.: Brazil), mother or caregivers sometimes use inappropriate ways to encourage their infants to eat.[7] Currently, WHO recommends that mothers/caregivers of infants younger than two years follow the responsive feeding practice, which employs the principles of psychosocial care.[79,80] This practice includes respect for the physiological mechanism that self-regulates the appetite in infants, helping them to feed until they feel satiated, and requires that mothers/caregivers be aware of the signs of hunger and satiety expressed by the infants. Infants should be fed slowly and patiently until they feel satiated; they should never be force-fed. Meals should be pleasant, with emotional exchange between the person who feeds and the infant, using eye contact, touching, smiling and talking. If infants refuse to eat several foods, different combinations, flavors, and textures should be attempted, and besides, noncoercive ways to encourage them to eat and that do not divert their attention during the meal should be used.[6] There is some evidence that active feeding improves food ingestion and the infant's nutritional status,[81] and development.[82,83]

Amount and frequency

The small amount of complementary foods initially offered should be gradually increased with age. The amount and frequency of foods should be based on infant's acceptance, which varies according to individual needs, the amount of breastmilk ingested and the content of complementary foods.[6,36] The infant should be encouraged to eat until he/she feels satiated.[6]

The current recommendations regarding the frequency of meals with complementary foods for breastfed infants result from theoretical estimates based on the energy provided by complementary foods, assuming a gastric capacity of 30 g/kg and an energy intake of at least 0.8 kcal/g.[6,36] The minimum frequencies of meals per age were calculated such that the requirements of almost all infants could be safely met.[36] Thus, WHO currently recommends two to three meals a day with complementary foods for breastfed infants between 6 and 8 months of life and three to four meals a day for those between 9 and 24 months, with additional nutritious snacks (pieces of fruit or bread, couscous, homemade cake, cassava) once or twice a day at 12 months.[6] If energy content or the amount of complementary foods per meal is small, or if the infant has been completely weaned, a higher frequency of meals may be necessary.[3,6,36]

It should be underscored that meals with complementary foods do not replace (but complement) breastfeedings. The frequency of breastfeeding can be maintained. With the introduction of complementary feeding, the infant will naturally begin to nurse less. Therefore, avoid an excessive number of meals with complementary foods in breastfed infants so as not to substantially decrease the amount of breastmilk ingested by the infant.[84] Nutritious snacks are time-saving and contribute less to milk displacement.[6]

Hygiene practices for complementary foods

Contaminated complementary foods are the major route of transmission of diarrhea among infants.[85] For this reason, the higher incidence of diarrhea in the second semester of life coincides with the increase in the intake of these foods.[86] Proper maternal practices regarding the management, preparation, administration and storage of complementary foods may reduce their contamination.[87]

Safe food hygiene practices include the following: those who handle the food, during preparation or feeding, should wash their hands properly with soap and water, after using the toilet and before meals, and the infant's hands should be washed likewise; kitchen utensils and cooking surfaces should be kept clean; only healthy-looking foods should be used and they should be kept in a safe place; an amount of food that suffices one meal only should be prepared and it should be served immediately after preparation; the infant should be fed from a glass or cup, spoon and plate, avoiding the use of baby bottles; infants should not be given leftovers from the previous meal; and, if using a fridge, it should be cleaned regularly and any spoilt foods should be thrown away.[35] Baby bottles are difficult to clean and are a major source of contamination. In Peru, an inspection revealed that 35% of bottle nipples were contaminated with *E. coli*. This bacterium was detected in 31% of teas offered in bottles, but in only 2% of teas served in glasses.[85]

If complementary foods need to be stored after preparation, they should be reheated at 70 °C. Otherwise, there is a high risk of contamination.[35] The storage of prepared foods should be discouraged. In Brazil, this is a practice observed among people with restricted time availability and economic conditions.[7] This is a dangerous practice, which should be systematically investigated, because, once it is socially unacceptable, it is not spontaneously reported by mothers.[88]

The adoption of proper hygiene practices for complementary foods can be hindered by lack of clean water, soap and utensils, but may be considerably enhanced by carefully planned educational interventions.[6,89] In Fortaleza, state of Ceará, in northeastern Brazil, a study carried out to check the possibility to change hygiene practices for complementary foods successfully implemented the following practices in over 50% of the mothers, whenever they fed their babies: not storing prepared foods, feeding the infants from a glass and spoon instead of from a bottle, washing their hands before offering the food, and boiling the water used to dilute instant milk or oatmeals. Maternal cultural aspects (beliefs and concepts regarding infant feeding, nutrition and health) and living conditions directly observed in their households were considered in the creation of educational messages, and the mothers were invited to participate as co-researchers by informing of whether or not the recommended practices could be performed. The promoted practices also were checked by direct observation of the households.[88,89]

Iron and vitamin supplementation

Iron

Exclusive breastfeeding provides iron requirements in the first six months in full-term babies, with good birthweight, and of mothers without iron deficiency, thanks to their body stores of this nutrient. However, after six months, liver iron stores become depleted and iron requirements have to be supplied by complementary foods. It should be highlighted that preterm low-birthweight babies have fewer iron stores and, because of that, should receive iron supplementation before the sixth month.[90]

WHO and UNICEF recommend ferrous sulfate supplementation at the dose of 12.5 mg of iron a day, for infants between six and 24 months who do not have access to iron-fortified foods. Low-birthweight infants should receive supplementation at two months of life.[91] In populations in which the prevalence of anemia is greater than 40%, WHO and UNICEF recommend the universal prescription of iron supplementation. In Brazil, a study conducted in São Paulo, showed that the universal prescription of weekly doses of ferrous sulfate (4 mg of elemental iron/kg) for infants/children between six and 59 months, who participated in public health programs

supported by the government, decreased the prevalence of anemia by more than 50% and was especially effective in the control of anemia in infants younger than two years.[92] The Brazilian Ministry of Health has a program for the reduction of iron-deficiency in towns of the Northeast region and of the state of Goiás, aimed at infants between six and 24 months, for whom ferrous sulfate was given in weekly doses of 45 mg of elemental iron. The medication is distributed in 30-ml flasks containing 25 mg of iron/ml, and 2 ml of the solution is administered weekly under the supervision of a health agent to the mother or caregiver. In 1999, this program reached a total of 336,500 infants between six and 24 months belonging to 512 towns of the Northeast. The Brazilian Ministry of Health is planning to extend this program to all towns attended by community health agents.[93] Global prevention in Brazil also includes the mandatory iron fortification of part of Brazil's manufacture of wheat and corn flours.

The Scientific Department of Nutrition of the Brazilian Society of Pediatrics recommends that full-term newborn infants between six and 24 months, with appropriate weight for gestational age, receive prophylactic elemental iron at the dose of 1 mg/kg/day or a weekly dose of 45 mg, except for infants receiving iron-fortified formulas. At 30 days of life, preterm babies and low-birthweight infants should receive 2 mg/kg/day, for two months. After this period, the same recommendation for healthy newborns applies.[94]

Vitamins

In general, exclusively breastfed infants of mothers who do not have any vitamin deficiency do not need vitamin supplementation, except for vitamin K (given as a routine in maternity wards). However, in some situations, supplementation with some specific vitamins is necessary.

Vitamin A

In Brazil, the Ministry of Health distributes megadoses of vitamin A in areas with high prevalence of vitamin A deficiency (Northeast region and Vale do Jequitinhonha), which are recorded on the Infant Card. Vitamin A is provided in capsules of 100,000 IU (for infants between six and 11 months of life) and of 200,000 IU (for infants/children between 12 and 59 months), administered at intervals of 4 to 6 months during immunization campaigns or according to the routine of health centers and community health agents.[95,96] In breastfed infants, the supply of vitamin A can be increased via maternal supplementation with this vitamin.[5]

The recommendations of the Scientific Department of Nutrition of the Brazilian Society of Pediatrics are similar to those established by the Brazilian Ministry of Health.[97]

Vitamin D

International organizations like UNICEF acknowledge that vitamin D supplementation (200 to 400 IU/day) is necessary when sunlight exposure is inadequate and that some babies are at greater risk for vitamin D deficiency than others.[98] Among the risk factors for vitamin D deficiency we have: maternal vitamin D deficiency during pregnancy, staying indoors and not being exposed to daylight, living in high latitudes, living in urban areas with buildings and/or pollution that block sunlight, having a dark complexion, use of sunblock, seasonal variations, covering much or all of the body when outdoors and replacement of breastmilk with low-calcium foods or foods that reduce calcium uptake.[99]

The American Academy of Pediatrics recommends that all U.S. infants eat at least 200 IU of vitamin D a day, and that breastfed infants should receive drug supplementation.[99] This recommendation is controversial and has a prohibitive cost for developing countries.[99,100]

Promotion of healthy complementary feeding

Most studies show that improvement in infant nutrition has a positive effect on infant growth. A recent systematic review revealed that out of 14 nutritional intervention studies, 12 showed a positive effect on growth, five of them used supplementary foods, two of them employed special preparations, and in four of them only nutritional counseling was used. Of note, the interventions that employed nutritional counseling, besides the positive effect on growth, improved maternal practices and infant nutrition, reduced the rates of anemia and improved the performance of health professionals.[101]

In Brazil, between 1998 and 2002, nutritional recommendations were developed for infants younger than two years, with support from the Brazilian Ministry of Health and the Pan-American Health Organization. This study, with the participation of nearly 300 health professionals and nutritionists from all over the country, was based on a previous diagnosis of the food and nutritional situation of infants in this age range and on results obtained from a qualitative Brazilian study on maternal feeding practices concerning infants younger than two years. This set of recommendations is known as " Ten Steps to Healthy Feeding of Infants Younger Than Two Years,"[7] and it has been implemented in Brazil in 2002 (Table 1).[7] The complete document that gave rise to the nutrition guidelines can be downloaded from the PAHO/Brazil website[102] and the manual for health professionals[95] can be obtained upon request from the General Coordination for Feeding and Nutrition Policies of the Brazilian Ministry of Health and their respective state representations.

In relation to current international recommendations, Brazilian recommendations[7] differ only in terms of the frequency of meals, which was based on previous WHO recommendations.[5] With regard to the new WHO recommendation about responsive feeding[6] – encourage the infant to eat the amount of complementary foods offered as accepted by the infant, – it is being implemented, giving special emphasis on the patience required to feed an infant and on the strengthening of mother and infant bonding during the meal.

Table 1 - Ten steps to healthy feeding of infants younger than 2 years

Step	**1**	Feed the infant exclusively with human milk up to 6 months. Do not offer water, tea or any other kind of food.
Step	**2**	After 6 months, gradually introduce other kinds of food. Keep providing human milk up to 2 years or longer.
Step	**3**	After 6 months, give complementary food (cereals, vegetables, meat, fruits) three times a day if the child is being breastfed, and five times a day if the child is no longer breastfed.
Step	**4**	Complementary food must be offered on demand, always respecting the child's appetite.
Step	**5**	Complementary food must be thick and it must be offered with a spoon; in the beginning it should have a pasty consistency (porridge/mashed food) and, gradually, it should get thicker up to the time when the child is able to eat a family meal.
Step	**6**	Offer the child with different kinds of food throughout the day. A varied diet is colorful.
Step	**7**	Stimulate the daily intake of fruits and vegetables.
Step	**8**	Avoid sugar, coffee, canned food, fried food, soft drinks, candies, and treats in the first years of life. Use a moderate amount of salt.
Step	**9**	Make sure to washed your hands before handling food; make sure the food is appropriately stored.
Step	**10**	Stimulate the sick child to eat. Offer the usual and favorite meals and respect the child's appetite.

Source: Brasil/Ministério da Saúde/Organização Pan-Americana da Saúde. Guia alimentar para crianças menores de 2 anos. Serie A . Normas e manuais técnicos no 107. Brasília, DF, Ministério da Saúde; 2002.

Although there are correct scientific recommendations, the promotion of complementary feeding is only successful when mothers/caregivers put these recommendations into practice.[3] To achieve that, the following items are crucial: definition of effective educational messages for the adoption of more positive practices;[89,103,104] being aware of the mothers' concepts and opinions about infant feeding;[105] acknowledgment and appreciation by the health professional of the mother/caregiver's ability as key element to infant health; practical help from the health professional, whenever necessary, helping the mother to perform feeding practices until she can do it by herself;[106] and identification and appreciation of maternal characteristics that show the distinctive quality of mothers who adopt positive feeding practices even when living in unfavorable conditions.[107]

Final remarks

Proper complementary feeding for breastfed infants is crucial for their optimal growth and development and, therefore, it is an essential component for food and nutritional safety of the population and national development. Food and nutritional safety implies the guaranteed right to permanent access to food, feeding with adequate quantity and quality, health feeding practices and respect for the cultural characteristics of each people. Since it is a right of infants and mothers, it is the government's duty to provide it, conjointly with civil society as well. It is the responsibility of health professionals to pass on the current information about proper infant feeding, with the aim of promoting the optimal growth and development of infants. This article presents national and international recommendations for the promotion of healthy complementary feeding. The challenge is to be able to convey them in an efficient way to the population and especially to mothers and caregivers.

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