

## **Module on Multimixes**

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### **Complementary feeding with multimixes:**

After the period of exclusive breastfeeding, the diet undergoes a change, from a single food - breast milk, to a variety of complementary foods **plus** breast milk, to meet infants' nutritional requirements. This period is associated not only with increasing and changing nutrient requirements, but also with rapid growth, physiological maturation and development of the infant. Poor nutrition during this critical period of life may increase the risk of growth faltering and micronutrient deficiencies, and may have adverse effects on health and mental development. Thus, improved complementary feeding practices at this period of life are among the most cost-effective public health tools. This module has been developed to introduce readers to complementary feeding with multimixes, enabling them to understand some important aspects such as:

1. foods that nutritionally complement breast milk, sustain growth, development and health;
2. how to introduce complementary feeding;

3. amount and frequency of complementary foods;
4. hygiene practices for complementary feeding;
5. promotion of healthy complementary feeding;
6. caregivers;
7. problems associated with the introduction of complementary feeding.

1. Foods that nutritionally complement breast milk, sustain growth, development and health

1.1. Energy content of complementary foods

1.2. Protein content of complementary foods

1.3. Mineral content of complementary foods

1.3.1. Iron

1.4. Vitamin content of complementary foods

1.4.1. Vitamin A

1.4.2. Vitamin D

1.4.3. Other vitamins

1.5. Selection of complementary foods

2. How to introduce complementary feeding
3. Amount and frequency of complementary foods
4. Hygiene practices for complementary feeding
5. Promotion of healthy complementary feeding
6. Caregivers

- 6.1. Psychosocial care
- 7. Problems associated with the introduction of complementary feeding
  - 7.1. Loss of appetite and infection
  - 7.2. Growth faltering and malnutrition
  - 7.3. Culture, customs, beliefs and food taboos

**Complementary feeding with multimixes:**

Appropriate breastfeeding and complementary feeding practices are fundamental to infant's nutrition, health, and survival during the first two years of life. Infant feeding in the early years of life influences an individual's whole life. Therefore, the nutritional adequacy of complementary foods is essential for the prevention of infant morbidity and mortality, including malnutrition and overweight.

The linear growth retardation acquired early on in infancy cannot be easily reversed after the second year of life. 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 and on the participation and support of civil society as a whole.

Around 6 months of age the mother's breast milk may not provide adequate calories and nutrients for the child's growth. At this period, infants like to put things in their mouths and are interested in new tastes. By this age the structure of the mouth in the infant is

well developed to make chewing and grinding movements, teeth eruption occurs, intestinal amylase increases and the tongue extrusion reflex which pushes out non-liquid food disappears, so the infant is ready to accept semi-solid foods. Mothers also realize that babies are not satisfied with breast milk alone, and frequently cry after feed.

The World Health Organization recommends exclusive breastfeeding until 6 months of age and continued breastfeeding for at least 2 years together with the introduction of adequate amounts of complementary foods of suitable nutritional and microbiological quality. In the population, infants exclusively breastfed up to 6 months are less affected by diarrhea and do not have growth deficits. This is true for both industrialized and developing countries.

### **1. Foods that nutritionally complement breast milk, sustain growth, development and health**

Complementary feeding means giving other foods in addition to breast milk. The aim is to introduce smoothly a soft digestible diet containing adequate calories, proteins and other micronutrients (especially iron, zinc, calcium, vitamin A, vitamin C and folate), free of contamination (pathogens, toxins or harmful chemicals), without much salt or spices, easy to prepare from family foods, easy to eat and easily accepted by the infant, in an appropriate amount, and at a cost that is acceptable by most families.

When starting complementary foods, continue breastfeeding as often as before – meaning as often as the infant wants. Keep the length of each breastfeed the same as before. However, as the infant gets used to complementary foods and begins to take it in adequate quantities, he would suckle less and breast milk secretion would proportionately

decrease. Usually, around 2 years, breast milk is entirely replaced by family foods, although a child may still sometimes suckle for comfort.

**Table 1.1 - Signs that a child is ready to start complementary feeding**

- <i>Is at least 4 months old;</i>
- <i>Receives frequent breastfeeds but appears hungry soon after or;</i>
- <i>Is not gaining weight adequately (first make sure there is no infection).</i>

Infants should be offered small quantities of semi solid foods once daily. The quantities are gradually increased and the range of foods is widened. The number of daily feeds is also gradually increased. As the infant is getting used to the foods being offered, the consistency is gradually thickened until solids are taken.

**Table 1.2 – Important aspects in relation to complementary feeding**

- <i>Rich in energy and nutrients</i>
- <i>Clean and safe;</i>
- <i>Easy to prepare from family foods;</i>
- <i>Locally available and affordable;</i>
- <i>Start with a few teaspoons and gradually increase the amount and variety;</i>
- <i>Actively encourage a child to eat at mealtimes and when having snacks;</i>
- <i>Make sure all utensils are clean;</i>
- <i>Spoon-feed complementary foods from a bowl or cup. Do not give from a feeding bottle;</i>
- <i>If complementary foods are not kept in a refrigerator, feed them within 2 hours of preparation;</i>
- <i>During and after illness, encourage a child to eat as much as possible at each meal. Continue this until the child regains any lost weight and is</i>

<i>growing well again;</i>
- <i>Keep a chart of a young child's weight. Monitoring growth is a useful way to know if the child is eating enough and is healthy.</i>

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 breast milk due to a poor breastfeeding technique, which leads to inadequate 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 breast milk and complementary feeding is not introduced unnecessarily. Another important cause to exclude is whether there is any infection. Infective illnesses are common causes of growth faltering. If possible compare the growth of the child with the WHO growth curve for breastfed children.

**Table 1.3 – Risks of giving complementary foods too soon**

- A child does not need these foods yet, and they may displace breast milk. As a consequence the mother produces less milk and later it may be more difficult to meet the child's nutritional needs;
- A child receive less of the protective factors in breast milk, so the risk of illness increases;
- The risk of diarrhea also increases because complementary foods may not be as clean as breast milk;
- The complementary foods given are usually watery porridges or soups because they are easy for babies to eat. These foods fill the stomach but provide fewer nutrients than breast milk;
- Mothers are at greater risk to get pregnant if they breastfeed less

frequently;
- Probably increases the risk of atopic diseases and type 1 diabetes mellitus.

**Table 1.4 – Risks of giving complementary foods too late**

- A child does not get the extra energy and nutrients needed;
- A child stop growing or grows slowly;
- Increase the risk of malnutrition or micronutrient deficiencies.

### **1.1. Energy content of complementary foods**

In all peasant communities, energy intake with the traditional complementary foods is well below requirements. Protein intake, though low, increases with age. The current view is that inadequate intake of energy, and not of protein, is the main etiological factor in infantile malnutrition.

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 breast milk, 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 breast milk they ingest, on the fat content in breast milk, and on the frequency at which they are fed complementary foods. For infants with an average breast milk 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.

Oil, butter, and honey are useful for raising the calorie content. In some regions these are expensive items and so foods which are sources of fat, like for example, groundnuts, sesame seeds, coconut and so on may be used instead. Palm oil is a useful source for both calories and vitamin A. Addition of fat and fat containing food items has another advantage besides raising the energy content, they guarantee the adequate intake of essential fatty acids and uptake of fat soluble vitamins (A, D, E and K). They also help to make the consistency of the gruel more liquid which makes it easy for the child to ingest. So, adding 1 teaspoon of oil or fat to a meal gives extra energy in a small volume. Sugar, honey and jaggery are also energy-rich and can be added to porridge and other foods in small quantities. Increasing the energy content with fats and oils would be one way of improving the intake of energy without altering the volume and thereby affecting the capacity for intake.

**Table 1.5 – Sources of energy in foods**

<b>Fats</b>	<b>Oils</b>	<b>High fat pulses and oil seeds</b>
Butter	Soy oil	Groundnut (peanut)
Ghee	Coconut oil	Bambarra nut
Lard	Sunflower oil	Soybean
Fat from meal	Groundnut (peanut) oil	Pumpkin seed
Margarine	Olive oil	Melon seed
	Coconut cream	Sunflower seed
	Maize (corn) oil	Sesame seed
	Palm oil	Shea butter nut
	Red palm oil	Cashew nut
	Sesame oil	Pine kernels

## **1.2. Protein content of complementary foods**

The recommended protein content (gram of protein per 100 kcal of food) for complementary foods is of 0.7 g/100 kcal, from 5 to 24 months. 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. : plantain, cassava and sweet potato).

It is of paramount importance that infants eat high quality and easily digestible proteins, which are found in breast milk and in animal products. In low income countries foods of animal origin are expensive and play insignificant role. Hence affordability ought to be considered in all nutrition advice being given. Often mothers are advised to use locally available and affordable food items to prepare the feeds. In Papua New Guinea, a list of protein foods includes insects (sago grubs), fish, beans, etc. High quality protein can also be provided by properly mixing some cereals or legumes (e.g.: rice and beans – the staple Brazilian food).

The protein in all staples is not as well balanced as in foods of animal origin. That is one reason why continuing with breast feeding during weaning is so important because of its content of high quality protein. All legumes have quite a high content of protein at about 18 per cent in the uncooked form. However, the quality of protein is not as good as that in foods of animal origin, but legumes contain those amino acids that are less plentiful in cereals. Hence a mixture of the cereals (e.g.: rice, maize, wheat, quinoa, millet, sorghum), and legumes makes a balanced form of protein. To such a food mixture limited amounts of foods of animal origin like for example, egg, pounded dried fish and so on may be added.

Dark green leafy vegetables are another group of food items that may be added, considering that their protein content is about 4 to 10 per cent, more when used in dried powder form. Their amino acid content complements that in cereals.

### **1.3. Mineral content of complementary foods**

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. From 9 to 11 months of life, the amount of minerals that should be provided by complementary foods is high.

#### **1.3.1. Iron**

Exclusive breastfeeding provides iron requirements in the first 6 months in full-term babies, with good birth weight, and of mothers without iron deficiency, thanks to their body stores of this nutrient. However, after 6 months, liver iron stores become depleted and iron requirements have to be supplied by complementary foods.

In developing countries, due to low iron intake and bioavailability (only approximately 11 to 18% of uptake), iron requirements often cannot be totally met. Infants aged between 6 and 12 months usually do not eat enough iron-rich foods to meet their requirements, in addition to the fact that the price of these foods can be prohibitive to low-income families. 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. On the other hand, eggs, milk, tea, mate or coffee interfere with iron absorption, since they form insoluble precipitates with iron. The inhibitory effect of whole cereals (rice, corn, wheat) is due to the presence of phytates. The foods and drinks which interfere with iron uptake should not be given with a meal, or during 2 hours before or after a meal.

WHO and UNICEF recommend ferrous sulfate supplementation at the dose of 12.5 mg of iron a day, for infants between 6 and 24 months who do not have access to iron-fortified foods. It should be highlighted that low birth weight babies have fewer iron stores and, because of that, should receive iron supplementation before the sixth month. In populations in which the prevalence of anemia is greater than 40%, WHO and UNICEF recommend the universal prescription of daily or weekly (45 mg) iron supplementation.

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 6 and 24 months, for whom ferrous sulfate is given in weekly doses of 45 mg of iron.

#### **1.4. Vitamin content of complementary foods**

In general, exclusively breastfed infants of mothers who do not have any vitamin deficiency are protected against vitamin deficiency, up to 6 months of age, except for

vitamin K (given as a routine in maternity wards). However, in some situations, supplementation with some specific vitamins is necessary.

#### **1.4.1. Vitamin A**

If the mother's diet has 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 and her infant should be offered vitamin A-rich foods, preferably some time before or after breastfeeding in order to increase the uptake of carotene and retinol from the diet. 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).

In Brazil, the Ministry of Health distributes mega doses 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 6 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.

#### **1.4.2. Vitamin D**

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 8 weeks. However, a few hours of sunlight exposure, 0.5 to 2 hours a week with exposure of the infant's face and hands

only, and 30 minutes a week, if the baby is wearing nothing but diapers produces enough vitamin D to avoid deficiency for several months. Dark-skinned infants require 3 to 6 times more exposure than fair-skinned babies to produce the same amount of 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. 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 sun block, seasonal variations, covering much or all of the body when outdoors and replacement of breast milk with low-calcium foods or foods that reduce calcium uptake.

### **1.4.3. 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.

### **1.5. Selection of complementary foods**

Infants 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.: overly diluted milks and soups) should be avoided.

Usually, from the 8<sup>th</sup> month onwards, foods should vary and balanced mixtures containing cereals, tubers, foods of animal (if possible) and vegetable origin, and fat should be offered.

Only a varied diet guarantees the supply of micronutrients (vitamins and minerals), enhances good eating habits and prevents the development of anorexia caused by monotonous foods. 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 (preferably salt fortified with the micronutrient iodine, if available). Avoid offering sugary beverages (soft drinks and others), as they reduce the infant's appetite for more nutritious foods and may soften the stools. 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. 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. If necessary, local food composition tables should be referred to.

There are two kinds of complementary foods: specially prepared foods and usual family foods that are modified to make them easy to eat and provide enough nutrients (example: to mash the foods to modify the consistency of the family foods, and to add oil or butter for extra energy or a piece of mango or carrot to give extra vitamin A).

In low-income countries affordability ought to be considered in all nutrition advice being given. Often mothers are advised to use locally available and affordable food items (preferably non-industrialized) to prepare the feeds.

**Table 1.6 –Usual types of staple foods**

<ul style="list-style-type: none"><li>• Cereal grain staples like maize, rice, wheat and millet.</li></ul>
<ul style="list-style-type: none"><li>• Non-cereal grain staples like potatoes, cassava, and plantains.</li></ul>

Cereal grain staples have a higher protein content of 7 to 10 per cent in the uncooked stage, but with boiling they absorb water and the protein content is reduced in the form they are eaten. For example, cooked rice is about two-thirds water. Tubers and roots absorb much less water, but their content in the raw uncooked form is lower at 1 to 2 per cent. Hence, with both kinds of staples, added calories in the form of oil, butter, honey, sources of fat (groundnuts, sesame seeds, coconut, palm oil, etc) is useful for raising the calorie content. The addition of fat or fat related foods (usually less expensive) makes the consistency of the gruel and other weaning foods more liquid which makes it easy for the child to ingest.

With cereal grains malting may be used. Grain is soaked in small amount of water overnight. Then dried, dehusked and ground into flour. During the process of soaking water is absorbed and enzymes such as  $\alpha$ - amylase are released which split the starch into dextrins, maltose and other sugars. Malted grain is more easily digestible and binds less water. Therefore the gruel prepared from such grain is more fluid in consistency.

As discussed in item 1.2, a way to improve the protein quality of complementary foods is to add legumes (beans, peas, etc) to cereals (rice, maize, quinoa, wheat, millet, sorghum, etc). The quality of protein is not as good as that in foods of animal origin, but legumes contain those amino acids that are less plentiful in cereals. Hence a mixture of the two makes a balanced form of protein.

Legumes need soaking for up to 24 hours followed by thorough cooking and mashing up. The nutrition composition, digestibility and cooking time of legumes are improved by sprouting. To begin with the child needs to get used to taste, and a 4:1 proportion of staple cereal to legume is recommended. As digestive tolerance increases the amount of

legume can be increased to make a 3:1 proportion. Addition of oil to such a double mix brings the energy and protein content to nutritionally adequate level. To such a food mixture limited amounts of foods of animal origin like for example, egg, pounded dried fish and so on may be added. Such foods contribute an important supplement of rich amino acids as well as other nutrients like iron and vitamin B.

Dark green leafy vegetables are another group of food items that may be added for their vitamin and iron content. Their protein content is about 4 to 10 per cent, more when used in dried powder form. Their amino acid content complements that in cereals. Their main role is with regard to vitamins.

- Common complementary foods in Nigeria include:
  - \*Pap with powdered crayfish
  - Pap with groundnut paste
  - Pap with groundnut paste and palm oil.
  - Pap with egg yolk
  - Pap with egg yolk and palm oil
  - Pap and unprocessed soya-bean powder (cooked together)
  - Pap and\*\* akara / moin-moin
  - Mashed yam and red palm oil
  - Yam pottage, powdered crayfish and green vegetable
  - Bread fruit with red palm oil

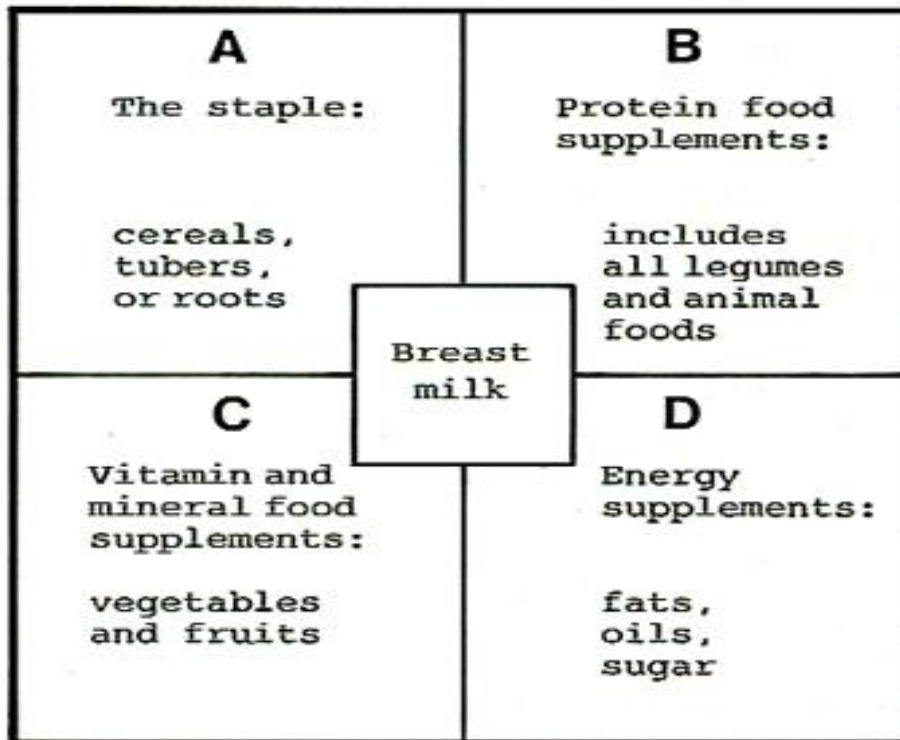
- Mashed yam, filleted fish and palm oil
- Pureed or mashed fruits (pawpaw and banana), orange juice.
- Corn porridge and roast groundnut

\*Pap can be made from maize, millet and sorghum and can be sweetened; \*\*dried shrimps.

Source: Infant and Young child feeding in Nigeria Guidelines. Federal Ministry of Health.

The above recommendation about complementary feeds takes into account the *principle of multimixes which means a mixture of affordable locally available and culturally acceptable foods based on the local staple. It is assumed that breast feeding continues while these feeds are introduced. Ideally, it should be designed to contain all needed nutrients that complement and mutually reinforce one another. In all mixes compact calories in the form of honey, butter, vegetable oil or fat containing foods* like groundnuts or sesame seeds in a pounded powdery form should be added. Experience has shown that this principle is easy to convey to young mothers when described as the Food Square:

**Figure 1 - FOOD SQUARE**



Multimixes formulated could be double mix, triple mix (described above for Nigeria) or quadrimix. An example of a quadrimix provided in India consists of:

- Wheat                      35 g
- Bengal gram              17.5 g
- Groundnuts                6.0 g
- Jaggery                      11.5 g

This mixture provides 9 g of protein; 260 kcal, 500 mg of sulpho amino acids and 400 mg of lysine.

A typical quadrimix provided for children in Kenya would consist of:

- oil or fat (butter, vegetable oil, margarine)
- protein rich food (mashed beans, peas)
- food rich in energy and nutrients (groundnuts, mashed soya beans mixture)
- food rich in micronutrients (mashed dark green leafy vegetables, mashed orange vegetables, pumpkins or carrot, tomatoes, orange or pawpaw or mango).

These multimixes should be popularized to provide appropriate foods among communities through community awareness seminars and community mobilization activities. Communities, families and individuals should be encouraged to use the land in a cost effective manner with 1:3 acres ratio of land use for legumes to grains.

Every community has a staple food, the main food eaten. Examples are cereals (such as rice, wheat, maize, millet), roots (such as cassava, yam, potato), and starch fruits (such as plantain and breadfruit).

## **2. How to introduce complementary feeding**

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.* Breastfed infants tend to accept new foods more easily than non breastfed ones, because via the breast milk, they are exposed to different flavors and scents very early on, which vary according to the maternal diet. Improper food consistency compromises the appropriate intake of nutrients by the infant. 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. Food consistency should be gradually improved, considering the infant's eating skills. The infant can be offered family foods, provided that they are crushed, shredded, chopped or cut into extremely small pieces. The offer of 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.

Complementary foods should be given using a spoon or glass, 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 and may cause nipple confusion, exposing the infant to a greater risk of early weaning. One should recall that the use of baby bottles is not necessary during the baby's growth. Complementary foods can be offered either before or after breastfeeding.

In some populations, mothers sometimes use inappropriate ways to encourage their infants to eat. Currently, WHO recommends that mothers/caregivers of infants younger than 2 years follow the responsive feeding practice, which employs the principles of psychosocial care (item 4). 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, non coercive ways to encourage them to eat and that do not divert their attention during the meal should be used. There is some evidence that active feeding improves food ingestion and the infant's nutritional status, and development.

It is important to emphasize that infants should not be stopped from breastfeeding in situations where a mother gets pregnant whilst still breastfeeding. The baby under this circumstance should be breastfed up to 16 – 20 weeks of pregnancy of the mother. The fetus normally needs minimal nutritional support from the mother at this time, and therefore breastfeeding will not affect the growth of the fetus nor deplete maternal nutrients. The period 16 – 20 weeks should be adequate for getting the child used to complementary foods.

### **3. Amount and frequency of complementary foods**

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 breast milk ingested and the content of complementary foods. The infant should be encouraged to eat until he/she feels satiated.

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. The minimum frequencies of meals per age were calculated such that the requirements of almost all infants could be safely met. 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, cooked potatoes or cassava, bread or chapatti with peanut, butter or honey) once or twice a day at 12 months*. 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. *It should be emphasized that meals with complementary foods do not replace (but complement) breast feedings. The frequency of breastfeeding should 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 breast milk ingested by the infant. Nutritious snacks are time-saving and contribute less to milk displacement.

#### **4. Hygiene practices for complementary feeding**

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

**Table 4 - Safe food hygiene practices**

<i>- Mothers/caregivers who handle the food should wash their hands properly with soap and water, after using the toilet and before meals</i>
<i>- Infants hands should be washed likewise</i>

- <i>Kitchen utensils and cooking surfaces should be kept clean</i>
- <i>Only healthy-looking foods should be used</i>
- <i>Foods should be kept in a safe place</i>
- <i>An amount of food that suffices one meal only should be prepared and it should be served immediately after preparation</i>
- <i>The infant should be fed from a glass or cup, spoon and plate, avoiding the use of baby bottles</i>
- <i>Infants should not be given leftovers from the previous meal</i>
- <i>If using a fridge, it should be cleaned regularly and any spoilt foods should be thrown away</i>
- <i>If complementary foods need to be stored after preparation, they should be reheated at 70 °C.</i>

*Source: Adapted from Monte C. Journal de Pediatria 2004; 80: S131-S141.*

***Baby bottles are difficult to clean and are a major source of contamination.***

The storage of prepared foods should be discouraged. In Brazil, this is a practice observed among people with restricted time availability and economic conditions. This is a dangerous practice, which should be systematically investigated, because, once it is socially unacceptable, it is not spontaneously reported by mothers.

The adoption of proper hygiene practices for complementary foods can be hindered by lack of clean water, soap and utensils. However, they may be considerably enhanced by carefully planned educational interventions like the one carried out by Dr Monte in Fortaleza city, Northeastern Brazil, advising mothers not to store prepared foods, feed their infants from a glass and spoon instead of from a bottle, wash their hands before offering the food, and boil the water used to prepare foods.

## **5. Promotion of healthy complementary feeding**

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 set of recommendations is known as Ten Steps to Healthy Feeding of Infants Younger than Two Years, and it has been implemented in Brazil since 2002. With regard to the new WHO recommendation about responsive feeding is to encourage the infant to eat the amount of complementary foods offered as much as is 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 5 - Ten steps to healthy feeding of infants younger than 2 years**

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*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, fruits, meat) three times a day if the child is being breast fed, 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 wash 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.*

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*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. To achieve that, the following items are crucial: definition of effective educational messages for the adoption of more positive practices; being aware of the mothers concepts and opinions about infant feeding; 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; 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.

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.

## **6. Caregivers**

### **6.1. Psychosocial care**

A number of studies in developing countries have linked inadequate psychosocial care and poor nutrition or health status. The most common caregivers are parents (usually mothers) but a great deal of care is actually provided by siblings and other family members, especially in third world countries.

Mothers of children with poor nutritional status were found to be more passive, less responsive and sensitive to the child's needs. These mothers tended to have low self-esteem, and be socially isolated. Mothers of undernourished babies were also observed to show significantly less positive non-verbal emotional responsiveness (through facial expression and touch) than mothers of adequately nourished children, both in a feeding situation and when asked to talk about their child. On the other way, in some studies undernourished children tended to show a greater need to maintain close proximity to the mother, which might be viewed as a sign of attachment insecurity. A child's nutrition status is probably also associated with the frequency of interactions and whom the child interacted with.

Three factors influence significantly the quality of psychosocial care: the characteristics of the caregiver, the support system for the caregiver, and resource constraints.

Improving complementary feeding requires attention to foods as well as to feeding behavior of caregivers. Infants and young children need assistance that is appropriate for their age and developmental needs to ensure that they consume adequate amounts of complementary food. This is called responsive feeding.

**Table 6.1 - Practice responsive feeding - applying the principles of psychosocial care**

<i>a) Feed infants directly and assist older children when they feed themselves, being sensitive to their hunger and satiety cues;</i>
<i>b) Feed slowly and patiently, and encourage children to eat, but do not force them;</i>
<i>c) If children refuse many foods, experiment with different food combinations, tastes, textures and methods of encouragement;</i>
<i>d) Minimize distractions during meals if the child loses interest easily;</i>
<i>e) Remember that feeding times are periods of learning and love – talk to children during feeding, with eye to eye contact.</i>

Caregivers often are unaware of the importance of responsive feeding, or do not know how to practice it. They need support from health professionals and community-based workers to acquire the necessary knowledge and skills.

Feeding behaviors are anchored in a wider belief system that influences what, when, where and how people feed their children. The most effective interventions are based on an in-depth assessment of this system; they address major barriers, using various channels and resources to support behavior change.

Current knowledge emphasizes the importance of focusing on the family rather than on individual caregivers in designing interventions to improve complementary feeding.

Assessing time allocation and time constraints in relation to food preparation and feeding are critical, as is estimating the real costs associated with implementing new feeding recommendations.

It is also important to promote safe preparation, feeding and storage of complementary foods in efforts to improve complementary feeding. Contamination and the proliferation of pathogens in food are major underlying causes of childhood diarrhea.

**Table 6.2 - Critical dimensions of responsive feeding**

<i>a) Feeding with a balance between helping and encouraging self-feeding, as appropriate to the child's level of development;</i>
<i>b) Feeding with positive verbal encouragement, without verbal or physical coercion;</i>
<i>c) Feeding with age-appropriate and culturally appropriate eating utensils;</i>
<i>d) Feeding in response to early hunger cues;</i>
<i>e) Feeding in a protected and comfortable environment;</i>
<i>f) Feeding by an individual with whom the child has a positive emotional relationship and who is aware of and sensitive to the individual child's characteristics, including changes in physical and emotional state.</i>

## **7. Problems associated with the introduction of complementary feeding**

### **7.1. Loss of appetite and infections**

When daily food intakes in infants and young children are monitored over a period of time, the important role of appetite in the control of food intake becomes clear. Loss of appetite or anorexia is often due to illness, the frequency of which rise sharply after the age of 6 months, as the passive immunity derived from the mother begins to decline.

The common infectious diseases of childhood, like chickenpox, diarrhea, respiratory infections, measles and others, usually occur in the first 3 or 4 years of life. In endemic areas, especially in Africa, repeated attacks of malaria are a constant drain on a child's health. These become more common from the age of 3 months onwards, until about the age of 1 year, when sufficient resistance is built up.

Diarrhea is a well-recognized hazard of the weaning period, a major associate of malnutrition. Several explanations have been put forward to account for the “weanling

diarrhea". Irritation of the gut by new and unaccustomed foods, change from a liquid to a semi solid diet and many other factors has been mentioned. But above all, ingestion of contaminants and large numbers of pathogens would appear to be the most important cause.

## **7.2. Growth faltering and malnutrition**

Growth is a highly sensitive process which requires the optimal functioning of the body's physiological processes together with an adequate supply of nutrients. Any illness, however mild, upsets the delicate balance and growth falters. Under normal circumstances, growth accelerates during recovery of an illness. This period of accelerated growth is known as catch-up growth. Catch-up growth requires additional nutrients. Observations on infants recovering from protein-calorie malnutrition have shown that such infants gain weight at a rate 2-3 times higher compared to normal infants of the same size. Protein synthesis is very expensive in terms of energy requirement, especially when it is realized that for glucose and fat, the maximum energy convertible to ATP is between 38 and 40 per cent. The remainder is released as heat. Thus, the energy needs of catch-up growth are heavy and there is a need for concentrated forms of energy and protein in the complementary foods.

In summary, each episode of infection causes a slowing of growth and even loss of weight if the illness has been severe, considering that during nutritional deficiency growth slows down to adapt to the low intake of nutrients. This is followed by a period of catch-up growth during recovery. If the interval between infections is too short, catch-up growth can not occur and there is progressive deterioration in the nutritional status. A short episode of diarrhea and resulting growth faltering can also have an effect on the

immune system. Again the amount of bulk in the diet is an important consideration. If the food contains as little as 1kcal/g a child weighing 10 kg would need to eat 1 kg of the food daily to consume enough calories. A sick child who is anorexic, coughing or vomiting would need to consume 300-500 g of the food at each meal and this may well be beyond his capacity.

In view of the known effects of illness on the nutritional status of the child, requirements of protein and energy should not be thought of in terms of physiological requirements alone. The food consumed must provide a substantial cushion for the stress of infection, in addition to supplying the physiological requirements of maintenance and growth. Even when the child eats well, the foods offered should be more nutritious, and some times are not sufficient for catch-up growth after an episode of infection.

The importance of breast milk in the first and second years of life by providing additional energy and protein helps to offset the energy constraints of a poor diet after an infection.

### **7.3. Culture, customs, beliefs and food taboos**

During each illness, either because of culture, customs, beliefs and taboos, in some regions of the world the child is put on a light watery diet consisting of tea and thin, watery gruels. He may also be given purges. All these have additive effects to those of the disease process.

Feeding has been on demand and often the breast has acted as a pacifier to the child, as well as a source of food. In some circumstances, because of the abruptness of the introduction of complementary feeding, and the false idea that mothers should stop breastfeeding when introducing these foods, a child who had hitherto been on a nutritious

diet of human milk has to change overnight to gruels which he/she may not take well or may not support the demands of growth.

In some societies in order to make the child give up the breast, to introduce complementary foods, all kinds of bitter applications are applied to the nipple. Thus, not only does the child find the mother suddenly refusing him her milk, but whenever he attempts to take the nipple into his mouth the bitter taste makes him give up. In many communities it is the custom to send the child away to the grandparents to separate him from his mother's breast. The mental confusion and psychological trauma produced by these practices are enough to take away the child's appetite.

Therefore, the time of the introduction of complementary foods is fraught with danger for a large proportion of the world's children, and nutritional disorders are common at this time of life. In poor regions of the world, parents are generally unaware of the dietary needs of children, and several customs associated with weaning are likely to give rise to nutritional deficiencies. For example, in many parts of India the ceremony of "Anna Prasanna" must be carried out at the time of weaning. In this ceremony, several kinds of foods are cooked and offered to the deity to invoke her blessings. Often weaning is delayed until such time as the family has been able to save for the expense of the ceremony. In Uganda and among several communities along the shores of Lake Victoria, the common practice is to separate the child from his mother in order to take him off the breast and to get him to eat other foods. The weanling is sent away to live with the grandparents for a few months.

In many communities there are superstitions and beliefs concerning the effects of another pregnancy on the quality of breast milk. It is believed that the heat from the womb

"poisons" the milk in the breasts. Also, that the baby in the womb is jealous of the older sibling on the breast. It is therefore considered urgent that the child should be taken off the breast immediately. In the ensuing hurry, there is hardly any time for the gradual introduction of solids to allow the child to get used to them. Instead, the breast is denied to him. In traditional societies the type and consistency of complementary foods introduced to the child are usually influenced by traditional practices, advice from the elders or family members, and the mother's own experience.

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