Introducing solid foods

Lombard MJ, PhD, NICUS Manager, Registered Dietitian
Labuschagne IL, BSc Dietetics, Principal Dietitian
Nutrition Information Centre, Stellenbosch University
Correspondence to: Martani Lombard, e-mail: nicus@sun.ac.za
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Abstract

There are recommendations to guide parents to help their infants make the transition from milk to weaning foods, but they differ in their focus in developed or developing countries and on the physiological and behavioural reasons that underlie the introduction of weaning foods. According to recommendations, ideally, term infants should begin weaning at six months, while breastfeeding should continue for two years. The recommendations on nutrients in complementary foods are based on the nutrient gap between the composition and volume of breast milk after approximately six months of exclusive breastfeeding and the physiology of infant nutritional requirements.

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Introduction

The World Health Organization (WHO) recommends exclusive breastfeeding until six months of age and continued breastfeeding for two years, together with the timely introduction of adequate amounts of safe and suitable complementary foods. At six months of age, complementary foods are introduced because breast milk no longer meets the nutritional requirements of the child.[1] By the end of the first year, infants should be accustomed to eating a variety of foods.[1] Recommendations on infant nutrition are based on the nutrient gap between the composition and volume of breast milk (~ 630 ml/day) after approximately six months of exclusive breastfeeding and also on the physiology of infant nutritional requirements.[2]

Timing of weaning

The WHO recommends six months of exclusive breastfeeding to protect infants from gastroenteritis-related morbidity and mortality.[3] However, there have been questions as to whether these recommendations apply to developed countries where the risks from episodes of gastroenteritis are minimal,[4-6] and whether infants who are weaned before six months are at risk of micronutrient deficiencies.[6,7] There are no reported disadvantages in beginning to wean infants onto solid foods between four and six months in developed countries.[8] The European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) and the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN) recommend exclusive breastfeeding for approximately six months, weaning from four to six months and continuous breastfeeding for two years.[9]

Complementary and weaning foods

Complementary food is semi-solid porridges that are given from six to eight months, while weaning food comprises small portions of solid food given until 12 months, when family foods are integrated. These foods should be hygienically prepared and culturally appropriate.[10,11] Complementary foods should be introduced one at a time to identify allergies and intolerances, and according to the developmental stage of the infant, starting with cereals, porridge with milk, puréed vegetables or fruit and then progressing to a mixed diet in mashed form. The sequence in which foods are introduced is not important.[12]

Introducing vegetables before fruits may increase vegetable acceptance.[12] According to Sullivan et al, infants develop taste preferences to foods in relation to frequency of exposure. Vegetable intake significantly increases after 10 days' exposure and infants who are fed breast milk demonstrate greater increases in vegetable intake than formula-fed infants.[13]

To encourage and establish healthy eating habits, parents and caregivers should offer a wide variety of dark green, leafy and deep yellow vegetables and colourful fruits. Pure fruit juices (115-170 ml/day) may be introduced into the diet after six months of age.[14]

During the complementary feeding period, > 90% of the iron requirements of a breast-fed infant must be met by complementary foods, which should provide sufficient bioavailable iron. Cow's milk is a poor source of iron and should not the predominant drink before 12 months, although small volumes may be added to complementary foods.[9] A limited gastric capacity and high nutrient requirements for energy and nutrients create the need for small, frequent, energy- and nutrient-dense meals.[2] The frequency of feeding should gradually increase from two to four meals per day by approximately six months of age, to four to six meals (including snacks in addition to milk feeds), when the infant is older than six months.[15]

Allergens in the diet

Current evidence does not support maternal dietary restrictions during pregnancy or lactation. Furthermore, there is not a strong relationship between the timing of the introduction of complementary foods and the development of atopic disease.[9] According to ESPGHAN, there is no convincing evidence that avoidance or the delayed introduction of potentially allergenic foods, such as fish and eggs, milk used in foods and cooking, cheese, yoghurt, wheat and other gluten-containing cereals reduces allergies, either in infants considered to be at increased risk, or in those who are not considered to be at risk.

Both early (< 4 months) and late (> 7 months) introduction of gluten should be avoided. Gluten should be gradually introduced while the infant is still being breastfed as this may reduce the risk of celiac disease, type 1 diabetes mellitus and wheat allergy.[9]

Nutritional requirements

The approach of the Food and Nutrition Board of the Institute of Medicine of the United States to formulate the dietary reference intakes (DRIs) represents a paradigm shift from avoiding deficiency states, as determined by clinical manifestation, to maximising health and improving quality of life. Reference heights for the DRIs are 64 cm for 2-6 months of age and 72 cm for 7-11 months of age, while reference weights are7 kg for 2-6 months and 9 kg for 7-11 months.[16] Most mixed diets, which are adequate in quantity and fed with appropriate frequency, will provide the necessary requirements.[2]

Energy intakes are calculated based on an assumed average breast milk intake of ~ 630 ml per day.[2] Therefore, energy needs range between 600 kcal/day (six to eight months), 700 kcal/day (nine to 11 months), and 900 kcal/day (12-24 months).[17] The weaning diets of infants in developed countries are normally high in protein with a protein:energy ratio of 2.5-3, because of a high protein density of complementary foods and a low percentage of infants still being breastfed after six months. There is some evidence that infants in the higher quintiles of consumption seem to carry a higher risk of becoming obese later in life. More than 14% of energy from proteins in the eight- to 24-month period may cause an early adiposity rebound and the development of overweight in young children. A low protein:energy ratio in many developing countries, where the available complementary food is mostly cereals, is also problematic. When the protein concentration of weaning foods falls below the lower limits of human milk (1 g protein/100 kcal), the infant's dietary requirements cannot be met.[18]

A dietary fat intake of 30-45% of total energy is recommended. The American Heart Association (AHA) has a limit of 40% fat of total energy with an emphasis on a more liberal intake of unsaturated fat and a focus on ensuring adequate intakes of omega-3 fatty acids in infants and children. There is also an emphasis on foods that are rich in nutrients and provide increased amounts of dietary fibre. The AHA further recommends diets that are low in saturated and trans-fats and healthy foods such as fruit, vegetables, whole grains, legumes, low-fat dairy products, fish, poultry and lean meats.[19]

Table I: The daily nutrient requirements, expressed as dietary reference intakes or recommended daily allowances, for infants from six to 12 months of age[2,16]

Nutrient	DRI/RDA for infants 6-12 months	Assumed intake from milk	Required from complementary foods
Energy (kCal)			
Girls	676	400	276
Boys	743	400	343
Total fat (g)	30	21.2	8.8
Protein (RDA) (g)	13.5	9.6	3.9
Calcium (mg)	270	152	118
Iron (RDA) (mg)	11	0.5	10.4
Zinc (RDA) (mg)	3	2.2	0.7
Vitamin A (mg)	500	86.4	413
Vitamin C (mg)	50	26.8	23.2
Vitamin D (mg)	5	1.2	3.8
Vitamin E (mg)	5	2.4	2.6
Thiamine (mg)	0.3	0.056	0.244
Riboflavin (mg)	0.4	0.164	0.236
Niacin (mg)	4	1.2	2.8
Pyridoxin (mg)	0.3	0.036	0.264
Folic acid (mg)	80	20	60

DRI: dietary reference intakes, RDA: recommended daily allowance

The DRIs for total fat are 31 g/day from birth to six months and 30 g/day from six to 12 months (Table I). The DRIs for the essential fatty acids linoleic acid (n-6) and α-linolenic acid (n-3) are 4.6 and 0.5 g/day respectively for six- to 12-month-old infants.[16] Currently, there are no DRIs for the long-chain polyunsaturated fatty acids eicosahexaenoic acid, docosahexaenoic acid and arachidonic acid, although these are particularly important in brain development and retinal function.[20]

Conclusion

Weaning should start between four to six months of age and breastfeeding should continue throughout weaning for at least two years, together with the timely introduction of adequate amounts of complementary foods. Initially, meals should be provided two to three times per day, and later three to four times per day with additional nutritious snacks, such as a piece of fruit or bread, offered one to two times per day, as desired.[21]

Global increases in childhood and adult obesity, diabetes and other lifestyle diseases highlight the need for health strategies to improve the quality of children's diets throughout the life stages.[22] It is increasingly realised that the effects of feeding, food composition, energy intake and dietary behaviour in several critical periods may be of paramount importance in health and well-being later in life.[23] Parents should avoid force feeding and overfeeding, while meals should be low in refined sugar, fat and saturated fat.[22, 23]

Conflict of interest

I declare that I have no financial or personal relationships that may have inappropriately influenced me in writing this paper.

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