

## FEEDING BABIES: 6 - 12 MONTHS

The information explosion in the science of nutrition very often creates the impression that available information is contradictory. Consequently, it is no longer easy to distinguish between fact, misinformation and fiction. The Division of Human Nutrition, Faculty of Medicine and Health Sciences, Stellenbosch University act as a reliable and independent source of nutrition information.

Normal growth and development requires food that will supply sufficient energy and protein. If these two requirements are met, vitamin, mineral and trace element deficiencies are unlikely, except in special circumstances.

### WEANING

The weaning period is defined as the progressive transfer from breast milk or infant formula to the usual family diet. Exclusive milk feeding will not meet the qualitative (e.g. iron) and quantitative nutritional needs of the infant during this period. Weaning is therefore the process of gradually letting the infant become accustomed to a full adult diet. The introduction of weaning foods is **in addition to** breast milk or infant formula, but **does not** serve as a replacement for either. By the end of their first year, infants should be accustomed to eating a variety of foods.

During the weaning period 60 ml/kg/day of milk would supply the required amount of protein (2 g/kg/day). It would, however, be deficient in energy, supplying only 156 kJ/kg/day. Therefore an additional energy source in the form of carbohydrates or fat is necessary. An infant who is (or should be) on a mixed diet should not drink more than 600 to 800 ml milk/day.

#### Possible consequences of exceeding 600 to 800 ml of milk feeding per day:

- ◆ Insufficient intake of other foods because of the volume of milk consumed
- ◆ Delay in the infant acquiring familiarity with, and a taste for, other foods
- ◆ Development of iron deficiency because of inadequate iron intake or associated occult blood loss from the bowel (cow (unmodified) milk enteropathy)
- ◆ Constipation

### Consequences of weaning onset

Inappropriate initiation of weaning together with malpractices can have undesirable consequences for the infant. When initiated **too early (before 17 weeks)**, weaning carries the risk of increased morbidity due to diarrhoea and food allergies, caused by external challenges introduced into the immature digestive tract, as well as infant under-nutrition (malnutrition) due to the normal decrease in maternal milk production as the infant is withdrawn from the breast. Equally, the **late** introduction of solid foods can lead to growth faltering, decreased immune protection and under-nutrition (malnutrition), when exclusive breastfeeding or formula feeding becomes inadequate. The inappropriate choice of weaning foods is known to lead to protein-energy malnutrition and a range of micronutrient deficiencies. Other possible long-term implications include interference with the infant's feeding behaviour, the development of obesity, hypertension, atherosclerosis and other diseases of lifestyle in later life.

### Weaning recommendations

Weaning is recommended to start at 6 months. At this age it is thought the infant's energy requirements cannot be met by breast milk or formula alone. The infant's renal and gastrointestinal physiology, as well as local immune response has matured sufficiently to cope with the increased variety of the weaning diet. Texture, consistency, type amount of food should complement the infant's feeding skills and development of the gastrointestinal tract. Infants can

mash as early as 6 months of age if encouraged to do so. If, however, they are not given the opportunity they may become increasingly reluctant to try new tastes and textures and manipulative behaviour may become a problem.

Weaning recommendations aim to prevent the development of any nutrient deficiencies in the infant. The most commonly observed nutrient deficiencies during infancy are inadequate energy and protein intake and deficiencies of iron, zinc, vitamin A and vitamin D. Ideal weaning foods should also be hygienically prepared (cleaned, cooked, covered and cooled) and culturally appropriate (available and acceptable to the population).

## INTRODUCING FOODS

It is generally advised that weaning foods be introduced in small amounts one at a time, starting with cereals, porridge with milk, puréed vegetables or fruit and progressing to a mixed diet in mashed form. The sequence in which these foods are introduced is not important. However, introducing one individual food at a time helps parents to identify any allergies or intolerance to particular foods. Introducing vegetables before fruits may increase vegetable acceptance. Commercial infant foods may be chosen for convenience, but eating nutritious food from the family pot is also a good and less costly alternative. The frequency of feeding should gradually increase from two to four meals per day by about six months of age to four to six meals including snacks per day in addition to milk feeds when the infant is older than six to seven months. Fruit juices may be introduced into the diet of infants after 6 months of age. If introduced it is recommended that 100% juices should be used and juice should be limited to approximately 110-170ml per day

| <b>SUGGESTED AGES FOR THE INTRODUCTION OF JUICE, SEMI-SOLID FOODS AND TABLE FOODS</b>   |                             |   |  |
|---|-----------------------------|---|--|
|   | <b>AGE (MONTHS)</b>         |   |  |
| <b>FOOD</b>   | <b>4-6</b>                  | <b>6-8</b>  | <b>9-12</b>  |
| Milk feeds  | Breast feeding can continue | The volume of milk feeds decreases from 150 ml/kg of the infant's weight to an average of 600 - 800 ml per day. | 600 - 800 ml per day<br>Unmodified cow's milk should not be used as the main drink before 12 months, although small volumes may be added to complementary foods.     |
| Iron-fortified cereals for infants, cooked strained porridge or pap   |                             | Add   | Add different textures such as infant cereals with fruit pieces, cereal bits and popped rice. The consistency and variety of cooked porridge can also be alternated. |
| Vegetables  |                             | Add strained / pureed; prepare hygienically and with no added sugar, salt, fat and oil.                         | Gradually eliminate strained foods and introduce table foods   |
| Fruits  |                             | Add strained / pureed   | Gradually eliminate strained foods. Introduce chopped, well-cooked or canned foods.  |
| Meat, chicken, liver or other organ meats and fish, dried beans, dried peas, dried lentils and egg yolk to ensure adequate protein and iron intake. |                             | Add strained / pureed   | Gradually eliminate strained meats. Increase the varieties of table meats offered.   |
| Finger foods, such as biscuits or toast   |                             | Add those foods that can be secured with a palmar grasp.  | Increase the use of small finger foods as the pincer grasp develops.   |

|   |  |  |                                       |
|---|--|--|---------------------------------------|
| Well-cooked mashed or chopped table foods, prepared without added salt or sugar |  |  | Add                                   |
| Juice or formula by cup   |  |  | Add; observe for possible aspiration. |

## SUPPLEMENTATION

### Iron

Postnatal erythropoiesis commences at four months and necessitates that iron intake is increased from dietary sources. Breast milk contains little iron, but it is well absorbed. Breastfed infants should therefore receive foods with high iron bioavailability (haeme iron as found in animal sources) or receive iron supplements. Formula milks have considerably more added iron in order to compensate for its reduced bioavailability. The bottle-fed infant should receive iron-containing formula for the entire first year of life, together with foods with high iron bioavailability. All soy formulae are fortified with iron, but should also be complemented with iron rich foods.

Recommended dosages for iron supplementation:  
2 mg / kg (elemental iron) body weight daily from 6 - 24 months

### ◆ Vitamins

A balanced diet including a variety of foods remains the most important source of the infant's vitamin / mineral intake. The use of balanced multivitamin preparations containing the RDA for infants in this particular age group is recommended especially for infants who encounter difficulties with weaning. Larger doses of vitamins have not been shown to have any additional benefits. Vitamin supplementation is indicated for children who suffer from chronic diseases, fat malabsorption or others on restricted diets, e.g. vegetarian diets or food intolerance.

However, most infants who are malnourished are at high risk of developing vitamin A deficiency. This is because these infants usually have poor diets, which are not sufficient in energy, protein and many other nutrients, including vitamin A. The routine provision, at a specified time interval in an infant's/child's life, of high-dose vitamin A supplements is an effective intervention for the improvement of vitamin A status in communities with a high prevalence of the deficiency. High-dose vitamin A capsules are often provided to infants from 6 months onwards.

Infants or children between 6 months and 6 years with malnutrition, acute recurrent infections and clinical eye signs of vitamin A deficiency (who have not had a high dose vitamin A supplement during the previous six months), should be given vitamin A according to the following schedule:

6 - 12 months: 100 000 IU orally stat

In infants with measles, HIV/AIDS and with eye signs of vitamin A deficiency above dosages should be given for two consecutive days.

## ALLERGENS IN THE DIET

The permeability of the mucosa decreases rapidly over the first few months. By 3-4 months of age only small molecules can pass through. Therefore the likelihood of foods provoking an allergic response decreases as the infant's gut matures. Foods commonly associated with adverse antigenic response include milk, soy protein, gluten, egg, peanuts and fish.

Avoidance or delayed introduction of these potentially allergenic foods, has not been convincingly shown to reduce allergies, either in infants considered at risk for the development of allergy or in those not considered to be at risk.

It is recommended to avoid both early (<4 months) and late (>7 months) introduction of gluten and to introduce gluten gradually while the infant is still breast-fed because this may reduce the risk of celiac disease, type 1 diabetes mellitus, and wheat allergy.

◆ Botulinum spores have been reported in honey or corn syrup. The addition of fresh (excluding flavouring of commercial products) honey to the infant diet should therefore be avoided.

### **Milk feeds**

If infant follow-on formula is used in the second 6 months of life, the quantity should be limited to 600-800 ml per day (see table of follow-on formula contents in previous issue: Feeding babies 0 to 6 months). The rest of the energy should be supplied from a varied food intake.

Whole cow's milk contains more protein, sodium, potassium, calcium, phosphorus and magnesium and less carbohydrate, iron, copper and vitamin C and D than human milk. Cow's milk is a poor iron source. It should not be used as the main drink before 12 months, although small volumes may be added to complementary foods. Low fat and skimmed milk are not recommended for infants until the age of two years as it has reduced energy, vitamin and essential fatty acid content.

Goat milk requires similar precautions, and in addition, is deficient in folic acid. Goat milk is as allergenic as cow's milk. Soy milk is indicated for infants who are allergic to cow's milk but not soy protein. It is however not indicated for the atopic infant or the prevention of allergy in the infant with a family history of allergies.

### **Constipation**

About 3 to 5 percent of all paediatric outpatient visits are related to chronic constipation. Adequate intake of fluid and fibre is important in the prevention and treatment of constipation, however, an excessive intake of milk (> 1000 ml) is one of the nutritional causes of constipation in infants. (Reduce milk intake to 600 - 800 ml per day). Intake of high fibre foods e.g. ready to eat weaning food and cereals, oats, fruit, vegetables and legumes should be encouraged. It is however not recommended that digestive bran should be added to the diet of infants. Regular use of stewed fruit (especially prunes) and a moderate intake of fruit juice may be helpful in the management of constipation.

## **NUTRITIONAL REQUIREMENTS**

Early life is a period of rapid growth, with the weight of the normal infant doubling by four months of age. Most mixed diets, which are adequate in quantity and frequency, will provide an infant's requirements (as outlined in the tables below) and complicated calculations in prescribing diets are, in general, unnecessary. Reference to these and other tables detailing food composition can be useful in the following situations:

- Infants failing to thrive, or showing specific signs of nutritional deficiency that cannot be adequately explained on usual history taking;
- Diets consisting of one food source only (e.g. a cereal);
- Weaning difficulties

### **MAINTENANCE FLUID REQUIREMENTS:**

Weight-related fluid requirements per day: <10kg: 100 - 120ml/kg  
10 - 20kg: 1000ml + 50ml/kg >10kg

## **NUTRIENT REQUIREMENTS: DIETARY REFERENCE INTAKES (DRIS)**

### **DRIs Reference Heights and Weights**

|             | Height | Weight |
|-------------|--------|--------|
| 2-6 months  | 64 cm  | 7.0 kg |
| 7-11 months | 72 cm  | 9.0 kg |

### **Energy**

|             |                    |
|-------------|--------------------|
| 0-0.5 years | 570 kcal (2394 kJ) |
| 0.5-1 years | 743 kcal (3121 kJ) |

### Macronutrients

|                          |            |              |
|--------------------------|------------|--------------|
| Protein                  | 13.5 g/day | 1.52g/kg/day |
| Fat                      | 30 g/day   |              |
| Linoleic acid            | 4.6 g/day  |              |
| $\alpha$ -linolenic acid | 0.5 g/day  |              |
| Carbohydrate             | 95 g/day   |              |

### Vitamins

|            |                 |                  |                 |
|------------|-----------------|------------------|-----------------|
| Vitamin A  | 500 $\mu$ g/day | Vitamin B6       | 0.3 mg/day      |
| Vitamin D  | 5 $\mu$ g/day   | Folate           | 80 $\mu$ g/day  |
| Vitamin E  | 5 $\mu$ g/day   | Vitamin B12      | 0.5 $\mu$ g/day |
| Vitamin K  | 2.5 $\mu$ g/day | Pantothenic acid | 1.8 mg/day      |
| Thiamine   | 0.3 mg/day      | Biotin           | 6 $\mu$ g/day   |
| Riboflavin | 0.4 mg/day      | Vitamin C        | 50 mg/day       |
| Niacin     | 4 mg/day        |                  |                 |

### Minerals

|            |            |            |                 |
|------------|------------|------------|-----------------|
| Calcium    | 270 mg/day | Iodine     | 130 $\mu$ g/day |
| Phosphorus | 275 mg/day | Selenium   | 20 $\mu$ g/day  |
| Magnesium  | 75 mg/day  | Chromium   | 5.5 $\mu$ g/day |
| Iron       | 11 mg/day  | Manganese  | 0.6 mg/day      |
| Zinc       | 3 mg/day   | Molybdenum | 3 $\mu$ g/day   |
| Fluoride   | 0.5 mg/day |            |                 |

\*The new dietary reference intakes - 2000

## MALNUTRITION

The rapid growth period in infancy is associated with increased vulnerability to nutritional deprivation. Malnutrition (referring to under-nutrition) is a nutritional disorder that devastates the lives of many of the world's children's population, including South Africa as indicated by the SAVACG study in 1994. These findings have been reconfirmed by the Food Consumption Survey in 1999.

**In addition to the known high (16%) prevalence of low birth weight babies (weight of less than 2500g at birth), the findings of the SAVACG (South African Vitamin A Consultative Group) national survey in 1994 in children younger than 6 years of age indicate that:**

- The growth of young children commonly falters in the first two years of life
- One out of four children is chronically malnourished and they do not grow to their full potential. This translates, approximately, to more than 1.5 million children. The quality and quantity of food intake is generally accepted as being crucially important in the rehabilitation of the malnourished child.
- Compared to international criteria these findings indicate that under-nutrition is a public health problem of moderate severity (22.9%).
- Wasting, an indicator of acute under-nutrition is not common (2.6%).
- Anaemia occurs in one out of five children (21.4%), and
- Poor vitamin A status occurs in one out of three children (33.3%), a nutritional disorder that is more common in rural areas.

Growth faltering occurs when the infant's growth is slowing down, remains static or is dropping in relation to the reference curve. If growth has failed, it is important to identify and investigate the underlying cause. There are many possible causes and each one should be investigated to determine the correct form of treatment.

## **Common causes of growth failure**

- Lack of or poor breastfeeding practices
- Incorrect alternative feeding practices / hygiene
- Insufficient / low energy solid foods as a result of ignorance or household food insecurity
- Frequent or severe infections e.g. diarrhoea, measles, acute respiratory infections, otitis media, TB / HIV
- Parasitic infestations
- Iron deficiency anaemia
- Vitamin deficiencies including vitamin A deficiency
- Fetal alcohol syndrome (FAS)
- Lack of maternal care

## **SUMMARY AND RECOMMENDATIONS:**

- The weaning process is recommended to start between 4 and 6 months.
- Inappropriate weaning onset can have undesired short and long-term effects on the infant.
- During weaning only one individual food should be introduced at a time, regardless the sequence of introduction.
- Introducing vegetables before fruits may increase vegetable acceptance.
- Recommendations for iron intake:
- Breastfed infants: about 1mg /kg/day by 4-6 months of age, preferably from supplemental foods.
- Recommended dosages for iron supplementation: 2 mg / kg body weight daily from 6 - 24 months
- Most infants who are malnourished are at high risk of developing vitamin A deficiency and should be supplemented accordingly (see text).
- Formula-fed infants: only iron fortified formula during the first year of life.
- Iron-rich and high protein foods include meat, chicken, organ meat, fish, dried beans, peas and lentils. The most common food allergens for infants include cow and goat's milk, soy, gluten, egg white, peanuts and fish. Avoidance or delayed introduction of these potentially allergenic foods, such has not been convincingly shown to reduce allergies, either in infants considered at risk for the development of allergy or in those not considered to be at risk.
- The volume of milk feeds decreases from 150 ml/kg to an average of 600 - 800 ml per day by 8 months of age.
- Staple foods such as porridge (pap), fermented or soured porridge or potatoes can be enriched by adding mashed foods rich in vitamin A, C, protein and iron.
- Dark green and orange vegetables are good sources of vitamin A, whereas fruit and fruit juices are good sources of vitamin C.
- By one year the infant should be eating a varied, balanced diet which is distributed over 5 meals a day, e.g. two family meals, one meal of enriched porridge and two snacks.
- If growth has failed (according to classification), it is important to identify and investigate the underlying cause.
- About 3 to 5 percent of all paediatric outpatient visits are related to chronic constipation. Proper nutritional treatment is important to prevent and treat constipation

**For further, personalized and more detailed information, please contact a dietitian registered with the Health Professions Council of South Africa.**

*References from the scientific literature used to compile this document are available on request.*

**Human Nutrition | Menslike Voeding**

Fakulteit Geneeskunde en Gesondheidswetenskappe /

Faculty of Medicine and Health Sciences

Universiteit Stellenbosch University

Francie van Zijl Rylaan / Drive; Tygerberg; Kaapstad / Cape Town

Posbus / PO Box 241; Kaapstad / Cape Town; 8000

Suid-Afrika / South Africa

Tel: +27 21 938-9259

e-pos

/

e-mail:

irene@sun.ac.za

[www.sun.ac.za](http://www.sun.ac.za)



forward together  
sonke siya phambili  
saam vorentoe

This article first appeared in Modern Medicine of South Africa and is reproduced here with kind permission of the publishers.