

## Nutrition and malnutrition in children

This chapter covers the important points about child nutrition and ways in which nurses can check on whether a child is getting enough of the right nutrients. It also covers *marasmus* and *kwashiorkor* and suggests ways to manage these conditions.

### Introduction

Making sure that children are well fed is the basis of health during childhood. Many of the illnesses that affect children are more serious if the child is poorly nourished and may even kill them. Nurses and midwives have a very important role in assessing a child's nutritional status, advising the parents on which foods to give and when. Children need relatively more food per kilogram than adults, as they burn up calories more quickly due to their higher metabolic rate, and also need extra calories to enable them to grow. Fat is the best way of increasing the calorie value of food and also in making it more appetising. Cooking oil is a readily available source of

**Table 43.1 Kilocalorie requirements per kilogram per 24 hours**

Age	Kilocalories
0+	110
3+	100
5+	90
10+	70
Adults	35–45

### Breast feeding

Babies should be breast fed as breast milk has many advantages over artificial milks.

### Nutritional advantages of breast feeding

The newborn baby should be put to the breast within the first hour after delivery, when he will get the *colostrum*, a rich source of antibodies.

**Protein:** The protein in breast milk is more easily digested than the protein in other milks.

**Fats:** The fats in breast milk provide most of the energy that the baby needs and are in the form of *polyunsaturated fats* which are important for the growth of the brain. Breast milk also contains the enzyme *lipase* which helps in the digestion of the fats.

**Sugars:** Lactose is the sugar found in breast milk and also provides energy for the baby. It also encourages the growth of the *lacto bacillus* which keeps the reaction in the gut acid and therefore helps prevent infection from harmful bacteria. The lactose also helps in the absorption of calcium which is important for healthy bone development.

**Iron:** Milk is not a good source of iron, but babies are born with iron stores which should last them until they are a few months old. The iron in breast milk is absorbed better than iron in artificial milks and breast fed babies do not become anaemic, unless they are born too early.

**Minerals and vitamins:** Breast milk contains the right amount of minerals and vitamins for babies. Cows milk contains too much of some minerals and can make a baby ill.

### Other advantages of breast feeding

**Protection from infection:** Breast milk contains *antibodies* and white blood cells which help prevent infection, as does the *lactobacillus* (see above). Breast milk is also clean and less likely to be contaminated than artificial milks. The *lactoferrin* it contains inhibits the growth of the *E Coli bacillus*. The baby therefore gets protection from diarrhoeal.

**Bonding:** Breast feeding helps develop a close relationship between the mother and the baby.

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**Availability:** It is always available and the mother can feed the baby at any time, wherever she is.

**Delaying the next pregnancy:** If the mother breast feeds regularly during the day and night, 10–12 times, with no long gaps between feeds, she is less likely to get pregnant again before the baby is 6 months old.

**Saves money:** Artificial milks are expensive. In Kenya, to feed a 6–10 month old baby with artificial milk can cost 60% of a labourer's wages.

**Less asthma and eczema:** Babies who are breast fed are less likely to develop allergic diseases such as eczema and asthma.

**Problems with artificial milks:**

- They do not contain the best nutrients for the baby.
- They are expensive. If money is short, the mother may make the feeds too weak, so that the baby does not get enough calories to grow well.
- They are easily contaminated and can cause diarrhoea. In many areas the water is not clean and the baby may be given dirty feeds. Bottles and teats are difficult to keep clean and many parents are not able to clean and sterilise them properly.

### Difficulties with breast feeding

Most difficulties can be overcome with a good technique. See Chapter 20.

If the baby has difficulty feeding because of a deformity, for instance cleft lip and palate, it is still possible for the mother to breast feed in some instances. If the baby cannot suck, the mother can be taught to express her milk and give it to her baby by cup and spoon. This is safer than using a bottle and teat, as the cup and spoon are more easily cleaned. In some countries, the use of bottles for feeding has been banned.

If the mother has died, see if there is another woman in the family who can breast feed the child. There may be someone who is already feeding one baby, but has enough milk for two. Even if the woman has not had a baby herself, if the baby is put to the breast frequently, she may start producing milk. See Chapter 20.

If mothers are HIV+ve the virus is unfortunately passed in the breast milk. If the family have enough money to buy artificial milks and are able to see that the feeds are always clean, it may be better to use artificial milks. In many circumstances, this is not

possible. The baby is more likely to die from poorly prepared artificial milks, so it is better to continue with breast feeding. Latest evidence suggests that if babies are given any food or fluid other than breast milk, the lining of the gut is damaged and when the mother breast feeds, the virus is more likely to pass to the baby. These babies should therefore be **breast fed only**.

Breast feeding should continue for as long as is possible, for example up to 2 years. However from the age of 6 months he will need additional food as well as the breast milk. Continuing the breast feeding alongside the weaning diet, gives the child valuable extra calories.

### Complementary feeding

The time when the child starts complementary feeding is the most difficult period as most diets are high in fibre and low in calories and the child has to eat great quantities to obtain the correct amount of energy. Foods are also easily contaminated and the child is at risk of getting diarrhoea.

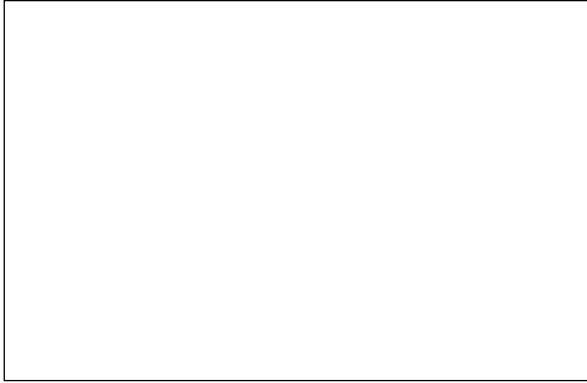
Complementary feeding should start when the baby is around six months old. He then begins to need more calories than he can get from the breast milk alone. Most of the extra feeding starts by giving the baby a pap or porridge made from the staple cereal. This is usually soft and easily taken by the baby. However, it may not contain enough nutrients and may be low in calories. It is essential that breast feeding continues and is not reduced, to ensure the baby gets enough calories.

### Improving food for the small child

Adding a little oil or fat (margarine or peanut paste) to the family food after cooking increases the energy and also makes the food easier for the baby to take. The volume of food that the child needs to take when oil has been added, is much reduced. Most communities have a staple food that is commonly available, such as cassava, maize, potato, green bananas, rice or bread. These can provide some of the energy required but are usually a poor source of iron, zinc or calcium.

The nurse needs to find out from the family the types of foods that are readily available and culturally acceptable before offering advice on the sort of foods to add to the diet. These may include some of the following:

- mashed up egg or pulses to give protein
- pounded groundnuts, which will give energy and other nutrients
- mashed fish or meat



**Figure 43.1** Food types

- mashed dark green vegetables. These should not be overcooked as this will destroy the vitamins. These are good sources of Vitamin A and C and also folate and iron, though the iron is not well absorbed
- mashed orange vegetables, such as pumpkin or carrots (Vitamin A and C)
- mashed tomatoes
- mashed fruits, such as pawpaw and mango
- iron rich foods which are well absorbed include liver, red meat and foods fortified with iron, such as fortified infant cereals.

There are also ways to make the porridge thinner and easier for the baby to take. This can be done by using a soured or fermented porridge, or germinated flour.

Germinated or fermented cereals have been used traditionally in many countries, and the practice should be encouraged. The advantage of using a fermented porridge is that bacteria are less likely to grow in it and it is therefore less likely to cause diarrhoea.

Germinated flour can either be used instead of a plain flour to make porridge, or it can be added to plain thick porridge, when the enzyme it contains will partly digest the cooked starch.

Small children need to eat more frequently than adults as their stomachs are smaller. They will need five to six feeds a day, as well as breast milk when they

start on solid foods. Snacks between main meals should be encouraged. By the time they are nine months old, they need four to five feeds a day as well as breast milk. As the child grows, he will be able to take more food at each meal and the number of feeds will reduce. It is important to remember when feeding children that the calorie and micronutrient value of the food is as important as the protein content.

Iodine is necessary for the production of the thyroid hormones. Lack of these hormones damages the growth and development of the body and brain. If this happens before the child is born, it can cause mental retardation, *cretinism*. After birth it can lead to poor development and the child is not able to learn easily. It can be prevented by adding iodine to salt and in many countries this is now done routinely. Iron is necessary to prevent anaemia.

## Monitoring nutrition

### **Pp** Taking the temperature

One of the most important roles of the nurse is to see that the child is getting enough of the right foods and is growing well. The child needs to be weighed each time she comes to the clinic and his weight plotted on a growth chart. It is then easy to see if she/he is growing at the right rate for his age. See Appendix (for growth chart and guidelines on how to fill it in).

However, growth charts are not always easily understood and mothers and guardians will need help in using them. Health personnel will need to be taught how to fill in the chart so that it becomes a useful measuring tool.

Another way of seeing if the child is growing well, if there is no growth chart, is by measuring the arm circumference. Between the ages of one and five years, the muscles in a well fed, healthy child grow bigger, but the fat becomes less, so that there is very little change in the arm circumference. So between these ages the arm circumference should be 16.5 cms. A child who has an arm circumference of less than 12.5 cms is very thin and badly nourished. The arm should be measured round the middle of the upper arm and can be done with an ordinary tape measure, or a special insertion tape.

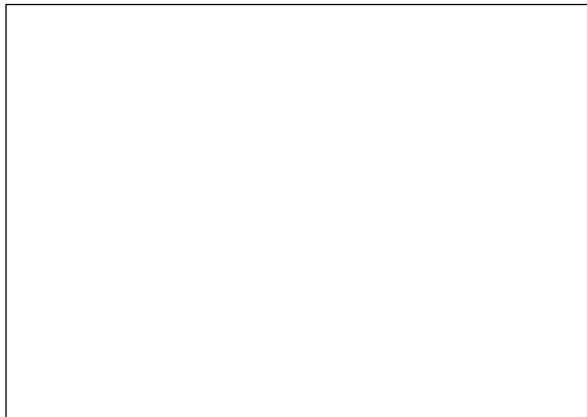
One of the most important roles of the nurse is to see that the child is getting enough of the right foods and is growing well. The child needs to be weighed each time she comes to the clinic and his weight

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**Figure 43.2**

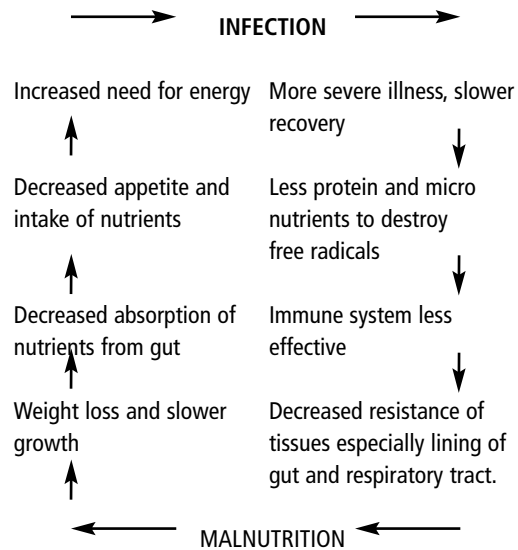
If no tapes are available, the nurse can learn to use her finger and thumb after practising.



**Figure 43.3**

The nurse then has to decide whether the child is well nourished, slightly malnourished or very malnourished. It is also necessary to find out whether any loss of weight is recent or whether the child has never gained weight properly. In all cases, it is important to ask the mother or guardian whether he has been ill recently. Sick children do not eat well and if he has also had diarrhoea, this may be another reason for a loss in weight. Also when a child has an infection he needs more energy.

If the weight is not satisfactory, the nurse must give the mother advice on how to increase the calorie content of the meals. The child may need encouraging to eat initially and the mother should offer several small meals a day. Very malnourished children should be admitted to a nutrition unit if possible and their feeding supervised.



**Figure 43.4**

Free radicals are highly reactive molecules which are produced during infections and can damage body tissues. When children are healthy, these are destroyed by *anti-oxidants* such as Vitamin A and Zinc. Protein also helps to remove them.

## Protein-energy malnutrition

### Marasmus

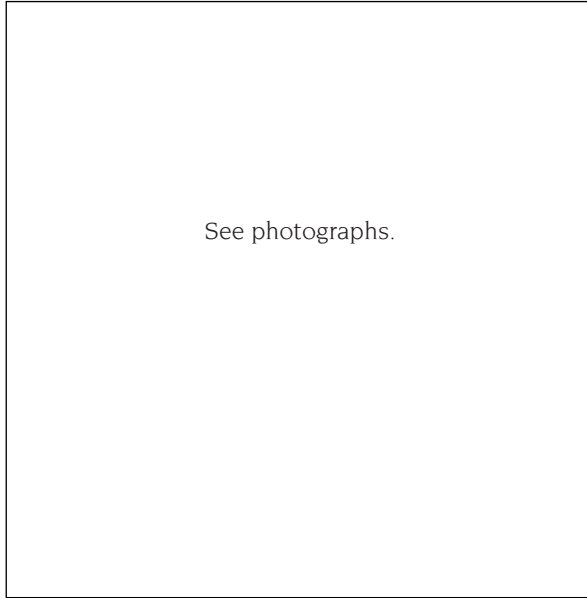
Marasmus is caused by children having a very low intake of energy and nutrients. It is most common during the period when solids are being introduced and often occurs when the child has been very ill or had several infections. It may also occur if the child is HIV +ve.

### Signs of marasmus

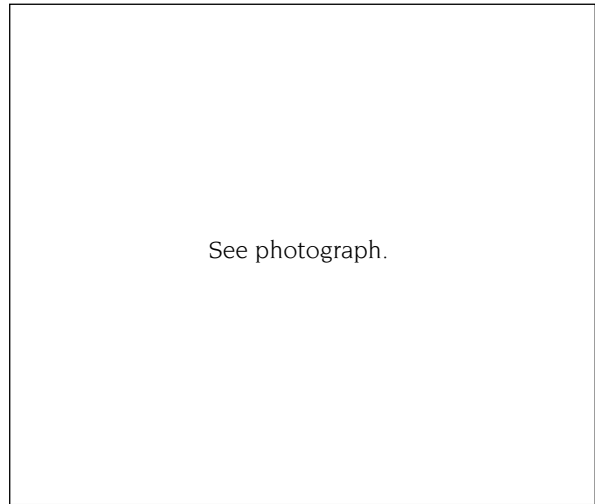
- Very low weight. The child will be below 60% of normal and the 3rd centile on the growth chart.
- Extreme wasting. The child has lost fat and muscle, so she looks thin, the arms and legs are like sticks and the buttocks are wasted. The arm circumference is often below 10 or 11 cm.
- Looks old. The face is wasted and the child looks worried and anxious.
- Pot belly. The abdomen sticks out, because the muscles of the abdominal wall are wasted and weak.
- Irritability. The child is fretful, she cries and complains.

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- Hunger. She may be very hungry as long as she is not ill.



- Miserable and apathetic.
- Poor appetite.
- Pale, thin peeling skin.
- Pale thin hair. The hair at the roots looks reddish in colour and can easily be pulled out.
- Enlarged liver which has become full of fat.



**Kwashiorkor**

Kwashiorkor is a more complicated form of malnutrition. It is mainly due to a very low intake of energy and nutrients as in marasmus but other factors are involved which are not completely understood. It is thought that it results when malnourished children have an excess of *free radicals* which have not been destroyed by anti oxidants. The child may recently have had a severe infection such as measles, large numbers of free radicals have been produced, but as the child is already malnourished they cannot be removed. These free radicals then damage the tissues, causing the signs of kwashiorkor. Another reason why children may have too many free radicals is thought to be due to the presence of certain poisons such as aflatoxin which is produced by a mould growing on groundnuts and maize.

**Signs of kwashiorkor**

- Oedema of the legs, arms and face.
- Moon face.
- Moderately underweight. He will not be as severely underweight as the child with marasmus, as he has oedema.
- Wasted and weak muscles. He may be unable to sit up or walk

**Complications of malnutrition**

**Diarrhoea:** The child may have acute diarrhoea due to an infection. See Chapter 25. Sometimes the wall of the gut gets damaged and the child is not able to absorb nutrients so well. The diarrhoea can become chronic.

**Dehydration.**

**Infections:** Often the child has an underlying infection but because he is malnourished may not have a fever. Common infections are otitis media, pneumonia, urinary tract infection and malaria. He may be HIV positive.

**Hypoglycaemia:** The blood sugar may fall very low and if it is not treated can result in brain damage.

**Hypothermia:** The child lacks the nutrients to burn to keep the body warm. This can lead to death.

**Anorexia.**

**Anaemia:** Most very malnourished children are anaemic due to a deficiency of iron and sometimes folate as well.

**Other nutritional deficiencies:** Other nutrients such as zinc and vitamin A may be lacking. This can be the reason for their low resistance to infection. Vitamin A deficiency can lead to a severe and sudden eye damage.

## Nursing care of the malnourished child

If the child is severely malnourished there are 10 steps to recovery. The first steps should be to treat for hypothermia and hypoglycaemia.

### 1. Prevention of hypothermia

- Take her temperature regularly. It is preferable to have a special low reading thermometer available as normal ones do not go below 35 Celsius. If no low reading thermometer is available, shake the normal one down to 35 degrees and if there is no reading assume hypothermia.
- Keep her close to her mother as her body warmth is the best way of keeping her warm. Use extra clothes and blankets as necessary and keep the child away from any draughts.
- Watch the child closely during the night as this is when the temperature is most likely to fall.
- Remember that the child will use up more calories to try to keep herself warm.

### 2. Prevention of hypoglycaemia

- Check for hypoglycaemia, using a dextrostix. If the blood sugar is below 3 mmol/litre, give glucose solution, orally or via a nasogastric tube.
- Immediate feeding should be commenced to prevent the blood sugar falling further. Feeds need to continue every two to three hours, and this must continue during the night.

Once the child has been checked for hypothermia and hypoglycaemia, a history can be taken.

### History taking

It is most important to get a good history from the guardian. The history must include the following questions:

- Has the child lost weight recently or has he never gained weight? Check with any recent weights on his chart.
- When did the guardian first notice there was a problem?
- Has the child been ill recently? If so does the guardian know what was wrong, how it was treated and if so is he still taking medicine. Urinary tract infections are a common reason

for children to fail to thrive. Tuberculosis and AIDS are also causes.

- Has he had any diarrhoea and if so how many episodes recently?
- How long was he breast fed, when was complementary feeding started and what food did she use.
- What does the child normally eat?
- How many other children are there in the family and is there a younger baby? Sometimes the weaning becomes malnourished when he is displaced at the breast by a new baby or the mother stops feeding when she becomes pregnant again.

### 3. Treat/prevent dehydration

The usual Oral Rehydration Solution contains too much sodium and too little potassium for severely malnourished children.

**Table 43.2**

Water	2 litres
ORS	1 packet
Sugar	50 g
Electrolyte/mineral solution	40 ml

- Use a modified solution. This should taste no saltier than tears.
- If the child is dehydrated, give 5 ml/kg every thirty minutes for two hours, then 6–10 ml/kg for four to ten hours.
- If the child has watery diarrhoea, replace the approximate volume of stool losses with the modified solution.

### 4. Correct electrolyte imbalance

Severely malnourished children have too much sodium in their bodies and may have too little magnesium and potassium. Oedema is partly due to these deficiencies. The children can be given an electrolyte/mineral solution which can be added to their feeds or to the rehydration fluid. sodium in their bodies and may have too little magnesium and potassium. Oedema is partly due to these given an electrolyte/mineral solution which can be added to their feeds or to the rehydration fluid. their feeds or to the rehydration fluid.

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**Table 43.3 Electrolyte/mineral solution**

Potassium chloride	224 g
Tripotassium citrate	81 g
Magnesium chloride	76 g
Zinc acetate	8.2 g
Copper sulphate	1.4 g
<b>Make up with water to</b>	<b>2500 ml</b>
This can be added to feeds.	

### 5. Treat and prevent infection

- Treat any infection as soon as possible. He may not have a fever even if he has an infection. Observe for signs of pneumonia.
- Test for malaria and treat if necessary.
- Remember he may have tuberculosis or be HIV +ve.
- Examine stools for worms and ova.
- Give a course of antibiotics as he is very susceptible to infection. Keep away from other children with infections.
- If he has not been immunized, measles vaccine should be given.
- He must be kept clean and all food and drink given to him must be clean.
- The nurse must wash her hands before giving him any care.

### 6. Correct micronutrient deficiencies

All severely malnourished children have vitamin and mineral deficiencies.

- He should be given a multivitamin supplement.
- Give Folic acid 1 mg per day (5 mg on the first day)
- Vitamin A should be given to all children who have not had a dose within the last month. Children whose eyes are affected should be given 2 further doses. Vitamin A protects the eyes and is also essential for the immune system.
- Iron can be started once he has started to gain weight.

### 7. Start cautious feeding

When a child is severely malnourished, the lining of the gut and other organs have often been damaged and feeding has to be very carefully started as often the child will have diarrhoea or go into heart failure.

- The child needs small frequent feeds.
- His diet should be low in protein and sodium.
- He needs extra potassium and magnesium

- He may be unwilling to feed, it may be necessary to pass a naso gastric tube.
- Feeds must continue during the night.

**Table 43.4 Starter feeds**

Whole dried milk	35 g
Sugar	100 g
Vegetable oil	20 g
Electrolyte/mineral solution	20 ml
<b>Or</b>	
Dried skim milk	25 g
Sugar	100 g
Oil	30 g
Electrolyte/mineral solution	20 ml

#### **Make up all mixtures to 1,000 ml of water**

Give small frequent meals.  
Aim for 100 cal/kg/day.  
Continue breast feeding.

### 8. Rebuild wasted tissues. Catch up growth

- He now needs plenty of food with high energy and nutrient content. He will usually start to feel hungry.
- Teach the guardian how to give the feeds and when to give them. The guardian is in a strange place and may not know what to do.
- Weigh the child twice a week.

**Table 43.5 Catch up feeds**

Whole dried milk	110 g
Sugar	50 g
Vegetable oil	30 g
Electrolyte/mineral solution	20 ml
<b>Or</b>	
Dried skim milk	80 g
Sugar	50 g
Oil	60 g
Electrolyte/mineral solution	20 ml
<b>Make up with water to</b>	<b>1,000 ml</b>

Gradually change from starter formula to catch up formula.  
The child should have about 200ml/kg per day of the formula.  
Continue breast feeding  
Gradually introduce family foods.

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### 9. Stimulation and play

Severe malnutrition causes mental and physical delay, so children should be encouraged to play once their physical condition has improved. A smiling, happy child is a sign that he is getting better.

### 10. Preparation for discharge and follow up

Teach the family about feeding the child in the future. There may be other families with the same problem, so it may be possible to give some group teaching sessions. There is no point in getting the child well if he goes home to get sick again, because the family have not been given any help.

## Health Education

Encourage breast feeding.

Give advice about suitable complementary feeding diets.

All children who are seen by a nurse either in a hospital or in a clinic should be assessed to see that they are growing well and are well nourished. It is easier to treat malnutrition if it is identified in the early stages.

Any child who is at risk should be followed up closely.

Children who have frequent infections should be very closely watched.

Children who are recovering from severe infections such as measles, need extra care.

## ■ Question/Activity

Hussein is fourteen months old when he is brought to the clinic by his mother with moderate malnutrition. What observations will you make and what advice will you give his mother?