

4.0 Introduction to solids

The introduction of solids is an essential learning experience for both the infant and family. It is the time when an infant's eating and health habits begin to be established. The overall objective of introducing solids is to gradually move an infant from breastmilk only at 6 months to eating a full range of healthy family foods by 12 months.

First attempts at eating may be slow and awkward. All infants develop at different rates and so do their feeding practices, appetite, etc. Caregivers should learn to respond to the infant's cues with patience so that feeding skills develop over a few months.

It is important to understand that the role of the caregiver is to choose the type of food, provide and make the food, and it's the infant's role to decide if they want to eat and how much.

Introduction of solids helps with the beginnings of speech, teeth and jaw development.

Recommendations from the *Dietary Guidelines for Children and Adolescents in Australia* (1)



The transition to solid foods

- Introduce solid food at around 6 months, to meet the infant's increasing nutritional and developmental needs.
- Start with low-allergenic foods such as single-grain baby cereals; follow this with vegetables and fruits and then meats. Add only one food at a time and wait several days before introducing a new food.
- To prevent iron deficiency, iron containing foods such as iron-fortified cereals are recommended as the first foods, followed later by foods containing meats and other iron-rich foods.

Alternate milk recommendations

- Use breastmilk or infant formula until the baby is 12 months.
- Pasteurised whole cow's milk may be introduced to a child's diet at around 12 months of age and be continued throughout the second year of life – and, of course, beyond. It is an excellent source of protein, calcium and other nutrients.
- Reduced fat milks (skim milk and milk with 1 or 2% fat) are not recommended in the first 2 years of life.
- Soy (except soy formula where specifically indicated), rice and other vegetarian beverages—whether or not they are fortified—are inappropriate alternatives to breastmilk, formula or pasteurised whole cow's milk in the first 2 years of life.

Other fluids in infant feeding

- Boil water that is to be fed to the infant until 12 months.
- Limit the infant's fruit juice intake, to avoid interfering with their intake of breastmilk or infant formula.
- Do not use herbal teas, soft drinks or other beverages.

4.1 When should solids start?

Breastmilk or infant formula provide all the nutrients required by an infant for the first 6 months of life and continue to be an important nutritional source until 12 months and beyond (1, 2, 3). At around 6 months the infant's iron and zinc stores begin to fall and energy needs start to increase. The infant should also be showing developmental signs consistent with a readiness to eat.

An infant is ready to eat when: (4)

- The infant has good head control and can sit with support.
- The mouth opens easily as the spoon touches the lips or food approaches.
- Reduced tongue thrust reflex—the tongue does not protrude as strongly as food enters the mouth.
- The infant can swallow instead of just being able to suck.
- Food stays in the mouth and is moved to the back of the mouth and swallowed.
- The infant is interested in the world around them, especially the caregivers eating.

It is important to note however that either early (before 6 months) or delayed introduction (after 6 months) of solids can be disadvantageous for the infant for the following reasons.

Early introduction of solids (1, 5, 6)

Early introduction of solids can displace nutrient-dense breastmilk or formula. This can result in inadequate nutrients and energy for growth. In some infants, early introduction of solids may encourage overfeeding and obesity if large amounts of solids are eaten in addition to usual amounts of breastmilk or formula. Giving other foods and fluids can lead to a reduction in the mother's breastmilk supply.

Since a young infant's digestive and immune system is not fully developed, the infant is placed at a higher risk of allergy and intolerance. Breastmilk helps protect against allergy and is recommended as the sole source of nutrition for the first 6 months.

Salivary amylases are present at 4 months, but pancreatic amylases which are responsible for digestion of carbohydrates are absent until 3 months, and remain inadequate until 6 months, thus affecting digestion.

The early exposure of infants to microbial pathogens potentially contaminating complementary foods and fluids puts them at increased risk of diarrhoeal diseases.

Before 6 months of age, the kidney is not able to cope with the increased solute load caused by solid foods and may result in overload and an excess of sodium in the blood.

There is an earlier return to fertility for mothers, because decreased suckling reduces the period during which ovulation is suppressed.

The common reasons given by mothers for starting solids early include: it will help the baby gain weight, it will help them sleep through, and they seemed ready for solids.

No benefits have been identified from introducing solid foods before the age of 6 months.

Delayed introduction of solids (1, 5, 6, 7)

Breastmilk or formula alone may not provide enough energy and nutrients and may lead to growth faltering and malnutrition.

Nutrient requirements change from 6 months. The iron and zinc stores present at birth have begun to decrease and need to be met by consuming a variety of foods.

Delayed introduction of solids can slow down developmental progress. The introduction of solids is important for jaw and muscle development and also for intellectual stimulation.

Growth can be affected if the amount of breastmilk or formula provided decreases and there is no resulting increase in food provided.

Texture transition guide

It is important that infants get the right sort of food textures at the appropriate times so that their oral muscles are exercised appropriately, and that they get plenty of practice so that they can move on to the next type of texture.

Children who have difficulty in progressing often stay either on a pureed or soft diet or skip some of the transitions. There are a number of possible causes for children not progressing with their transition of solids. These include:

- children who have had previous difficulty with lumpy or chewy foods and may be reluctant to try again
- children who have difficulty breaking down the lumpy or chewy food
- children who have difficulty using their tongue to move the lumps in their mouth

Children who are unable to progress through the textures will probably experience limited food choices and, therefore, may limit their consumption of essential nutrients. For some children there may also be a link between difficulty in progressing through food textures, and delays in their speech and language development.

Developmental stages

Birth

- At this stage the tongue takes up most of the space in the mouth. This allows sufficient sucking to occur with simple forward backward movements of the tongue.

4 – 7 months

- Improved motor function, eg head and neck control, hand movements.
- There is growth of the mouth giving the tongue more room to move and assist the baby to gain control.
- 'In and out' movements characteristic of the first few months are gradually replaced by 'up and down' movements of the tongue.
- Feeding becomes voluntary with the tongue moving 'up and down' in the mouth.
- Early munching pattern of the jaw can be seen when fed pureed solids.
- Increased strength of suck.
- Movement of gag reflex from mid to posterior third of tongue.
- Early cup drinking can be introduced at this stage.

7 – 12 months

- Hand to mouth coordination improves to facilitate self feeding.
- Baby starts to clear spoon with lips.
- Experimentation with sounds when hands, fingers or other objects are in their mouths.
- Development of 'up and down' and lateral tongue movements in preparation for chewing.
- Lip control improves while chewing to prevent spillage of food.
- Jaw movements are characterised by 'up and down' movements, which is called the munching pattern.

12 – 24 months

- Begin to self feed which is very important for tactile and motor development.
- At this stage the child is eating with the family and the main form of drinking is from the cup.
- Rotary chewing movement and improved jaw stability.
- Foods are moved efficiently around the mouth, spillage is uncommon.
- Chewing and the lip seal are well developed so that food and liquid are not lost from the mouth.



Please refer to parent handout

Fun not Fuss with Food Fact sheet 1 *Importance of Nutrition*

Growing Strong Starting Solids brochure

4.2 How should solids be started?

Initially, the introduction of solids may be slow and uncoordinated, but with patience, persistence and time, the infant will develop skills. Breastmilk or infant formula should continue to be the primary milk source for the first 12 months of life. The quantity of breastmilk or infant formula consumed will decrease as the variety and quantity of other foods increases.

- Choose a time when the infant is happy and the caregiver is calm.
- Provide a secured sitting or slightly reclined position, eg on the lap.
- Offer about half a teaspoon, with smooth edges, of solids AFTER a breast or formula feed.
- Start with offering solids once a day and gradually build up to 3 times a day over 2 months.
- 2 – 3 meals per day for infants aged 6 –8 months (8).
- 3 – 4 meals per day for infants aged 9 – 11 months and children 12–24 months.
- Introduce one single food at a time, one new food every 3 - 4 days.

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- Typically 8– 10 exposures are needed, with clear increases in food acceptance appearing after 12 – 15 exposures (5)
 - Once single foods have been introduced successfully, start to offer mixed meals, eg rice cereal, minced meat and vegetables.
 - Do not add sugar, honey or salt to foods.
 - Do not put the spoon or food in adult's mouth before it's given to the infant – this passes in bacteria that can cause tooth decay.
 - If any of the infant's relatives are allergic to a food, wait until 12 months to introduce it and wait 5 – 6 days before introducing the next food.
 - The use of commercial foods may delay the infant's acceptance of the family's normal diet and represents an unnecessary financial burden.

4.3 What solids should be started and when?

From 6 months

When starting solid food it needs to be warm, sloppy, smooth in texture and mild in taste. It is important for the infant to learn the difference between liquid and solid foods, therefore solids should not be provided in a bottle.

What

- Continue to breast feed on demand or formula feed (about 5 – 6 bottles of 200 ml each).
- Give solids after breastmilk or formula feeds.
- Single grain iron enriched baby cereal, eg iron fortified rice cereal. Mix with breastmilk or formula to a smooth paste. Cereals with wheat are not suitable at this stage.
- Vegetables that can be cooked and finely mashed/sieved, skins removed.
For example potato, sweet potato, pumpkin, carrot, zucchini, peas, and legumes.
- Fruit that has been pureed and sieved, skins and seeds removed.
For example, soft cooked apple, pear, peach, apricot, banana, avocado, paw paw.
- Meats that have been cooked, pureed and sieved.
For example, beef, lamb, pork, chicken, legumes.
- Cooled boiled water can be offered from a cup with a spout.

Texture

Smooth, pureed (use a blender, food processor or sieve). Semi liquid at first, then more paste like.

How much

Start with ½ teaspoon and build up to 2 – 4 tablespoons.

Tips

- By starting vegetables first infants are more likely to enjoy the taste now and later in life. Follow with fruit, and once the infant is eating a variety of vegetables and fruit start to introduce meats.
- Foods prepared in the home with fresh ingredients are desirable because fresh foods:
 - allow the infant to be introduced to a single food taste at a time,
 - increase the variety of foods that can be offered,
 - can be more economical and
 - assist the infant in becoming familiar with normal family foods.
- Commercially prepared baby foods are a nutritious alternative. If relied on totally, they restrict an infant from experiencing other food tastes, as they often contain foods in a mixed form which are similar in taste and texture.
- It is often useful to prepare batches of food which can be frozen as ice cubes for later use and sealed inside labelled plastic bags. They defrost quickly over hot water. The food should be stirred well to even out the temperature and tested before giving to the baby. Discard any food left over from a meal. It is best to discard prepared frozen foods after 3 – 4 months. If the foods are stored in the refrigerator, they should be discarded after 1 day.
- Prepare food without adding salt. It is best to allow an infant to develop tastes with unseasoned foods.
- Once the infant has teeth, brush teeth twice a day using a clean soft cloth or small soft toothbrush and a thin smear of low dose fluoride toothpaste.
- Continue to check growth regularly. Refer to growth chart section.



Please refer to parent handout

Child and Youth Health Fact Sheet *Feeding from 6 months*.

From 8 months

The infant should be eating pureed meats, baby rice cereal, pureed fruit and vegetables with continued breastmilk or formula.

What

- Continue breastfeeding on demand or formula feeding (90-100 ml/kg body weight/day). Give solids before breastmilk or formula feeds.
- Add mixed infant cereals, oats, barley, rye, semolina, rice pasta, wheat flaked biscuits and rusks.
- Vegetables – all sorts cooked and mashed with soft lumps.
- Fruit – all kinds with skin and seeds removed.
- Meat – continue as at 6 months but add in fish (fresh or tinned unsalted water packed) and egg yolks.
- Cooled boiled water from a cup with a spout.

Texture

Mashed, some lumps can be tolerated. Stop pureeing. Important to encourage texture transition – if this is delayed it can lead to fussy eating as the infant gets older.

How much

2 tablespoons to ½ cup

Build up to 3 times a day

Sample menu

Breakfast

Baby cereal (3-4 tablespoons) mixed with breastmilk, formula or water

Mashed fruit 2 tablespoons)

Breastmilk or infant formula

Mid morning

Breastmilk or infant formula

Lunch

Strained (blended) meat (2 tablespoons)

Strained (blended) vegetables (2 tablespoons)

Breastmilk or infant formula

Mid afternoon

Breastmilk or infant formula

Dinner

Strained (blended) meat or fish (2 tablespoons)

Mashed vegetables (2 tablespoons)

Strained (blended) fruit (2 tablespoons)

Breastmilk or infant formula

Check

- ✓ gradually change the texture from smooth puree, to mashed with a fork, to mashed with lumps
- ✓ the infant is the only one who knows when they have had enough
- ✓ this period can be quite messy, but this is normal
- ✓ sugar and salt should not be added to solids
- ✓ check the infant's growth regularly
Refer to growth chart section

Please refer to parent handout

Child and Youth Health Fact Sheet *Feeding from 8 months*.



From 9 months

The infant should be eating meat and fish, cereals, fruit and vegetables as well as breastmilk or infant formula. By 9 – 12 months, fine motor control and pincer grip should have developed. An infant should be eating the same foods as the rest of the family and being encouraged to experiment with finger foods and self feeding.

What

- Continue breastfeeding on demand, if formula fed (90 – 100 ml/kg body weight/ day) ie around 600 – 800 ml/day.
- Cereals – continue with infant cereal for iron, white or wholemeal bread and toast.
- Vegetables – include all vegetables, including some raw.
- Fruit – include all, remove tough skins and large seeds, soft fruits given in pieces.
- Meat – remove all skin, gristle and bones from meat.
- Dairy – full fat dairy products, eg yoghurt, custard, grated cheese and cottage cheese. Pasteurised cow's milk in the preparation of main meals and desserts. Milk should not be provided as a drink until 12 months.
- Cooled boiled water from a cup with a spout.

Texture

Pieces or chopped – finger food.

How much

3 meals a day with some snacks, about 1½ cups at each meal.

Tips

- ✓ The change in texture is very important for jaw and speech development.
- ✓ Finger foods are popular and the infant should start to self feed.
- ✓ Lollies, soft drinks, cordials or other sweetened foods are not recommended. They can displace other important nutrients, interfere with appetite, cause diarrhoea and lead to tooth decay.
- ✓ It is best to leave hard foods such as popcorn, corn chips, hard lollies and some hard raw fruit and vegetables until four years of age to avoid choking.



Please refer to parent handout

Child and Youth Health Fact Sheet *Feeding from 9 months*.

From 12 months

The child should be eating a wide variety of family foods. Sweet, salty, processed or fatty foods should be avoided.

What

Foods to include

- Full cream cow's milk
- Whole egg
- Peanut butter
- Unboiled water

Texture

Family foods – some foods will need to be cut into small pieces.

How much

- Continued breastfeeding is recommended. Breastmilk still provides important nutrients into the child's second year of life.
- After 12 months infant formula can be replaced with cow's milk. No need for infant follow -on formula.
- Give solids before fluids.
- 3 meals a day and snacks. This is dependant on age, growth and activity levels.

The National Health and Medical Research Council have not developed nationally endorsed food group servings for 1-3 year olds as it has for children four years and older. At this age there is marked variability in how much individual children eat. How much food is eaten varies from child to child and from day to day and is influenced by growth and activity levels.

Ensure that the child has foods from all five core food groups and has a variety of foods from within each food group. The emphasis is on healthy family foods and having an environment around eating that encourages healthy food behaviours. Intake can be monitored by assessing the child's growth and development.

The following sample menu is a guide only.

Sample menu

Breakfast

Cereal made with milk
Toast with spread
Fruit
Breastfeed/milk drink

Morning tea

Toast or crackers with spread
Drink of milk
Fruit

Lunch

Meat/chicken/fish/egg/legumes
Vegetables (raw or cooked)
Bread

Afternoon tea

Yoghurt
Pikelet or fruit bread
Fruit

Dinner

Meat/chicken/fish/egg/legumes
Vegetables (raw or cooked)
Rice/pasta/noodles

Avoid honey for infants less than one year of age. The organism that causes infant botulism has been found in some honeys in Australia. The infant's gut at this age does not have enough resistance to provide adequate protection from these bacteria which produces a lethal toxin. It should, therefore, be excluded from the diet until after 1 year of age (5).



Please refer to parent handout

Child and Youth Health Fact Sheet *Feeding from 12 months*.
Child and Youth Health Fact Sheet *Solids Table*.
Child and Youth Health Fact Sheet *Recipes for Babies*.
Fun not Fuss with Food Fact Sheet 2 *Is this Normal?*

Allergies

If there is a family history of allergy try to delay the commonly allergenic foods until 12 months especially where there is a strong family history of previous reactions in caregivers or siblings.

Foods should never be restricted in children unnecessarily as growth and health may be affected. If in any doubt the general practitioner should be consulted. A referral to a paediatrician and dietitian can then be arranged.



Refer to section on allergies.
Please refer to parent handout

Child and Youth Health Fact Sheet *Food Allergies*.

4.4 Drinks

Water is the fluid of choice. It needs to be clean and boiled for infants less than 12 months of age. It is good to encourage children to accept the taste of water from an early age and to consume appropriate amounts. Water is essential, not only to ensure the infant/child remains well hydrated, but also to assist in maintaining regular bowel activity. Breastmilk is 87% water, so exclusively breastfed infants who are breastfed on demand will generally receive adequate fluid. Non breastfed infants need at least 400 – 500 ml/day extra fluid from other sources when complementary foods are given, as well as infant formula, and up to 1200 ml/day in a hot climate.

Fruit juices, soft drinks and cordials should be avoided. They contain sugars which, because of their acidity can cause dental caries and erosion of the teeth and may replace the amount of breastmilk or formula consumed and may also initiate a preference for sweet tastes. These drinks are also very high in energy; while providing limited satiety they contribute a significant amount of energy to the diet. These should never be given in a bottle. In 2003, 15% of children in Queensland, less than 1 year of age, had been given sweet drinks regularly (9).

Tea is not suitable for infants and young children. Tea contains tannins and other compounds that bind iron and reduce its bioavailability. Herbal drinks/preparations are not suitable for infants and young children. Infants are potentially more vulnerable than adults to the pharmacological effects of the chemical substances in herbal drinks. There is a lack of data on the safety of herbal teas for infants.

Milk remains an important drink throughout childhood and as such, consumption of adequate amounts should be encouraged. Include up to 500 ml/day only.

An infant or child should be encouraged to drink from a cup by about 6 months.

Parent handout

Growing Strong Healthy Drinks for Babies

NSW Health *Teach your baby to drink from a cup.*



Check

- ✓ **Try not to expect too much. Infants and children have small appetites and stomach capacities.**
- ✓ **Allow an infant to exert some independence. Do not force an infant or child to finish everything on the plate.**
- ✓ **Turn a blind eye to the mess produced as a result of the feeding attempts.**
- ✓ **A relaxed and comfortable atmosphere during meals will facilitate good eating practices, as well as providing an opportunity for social interaction and cognitive development.**
- ✓ **It is normal for an infant's stools to change in colour and consistency as solids are introduced. Refer to constipation section for more information.**
- ✓ **Vegetarian diets in infants can be concerning due to the high risk of nutritional deficiencies, malnutrition, growth retardation and delayed psychomotor development. Infants should be referred to a paediatric dietitian or paediatrician to assess the adequacy of the diet and appropriate growth.**

4.5 Salt in food

Dietary salt is an inorganic compound consisting of sodium and chloride ions. It is found naturally in many foods, but it is also added to many foods because of its preservative and flavouring characteristics.

Recommended intake for sodium (1)

0 – 6 months	140 – 280 mg per day
7 – 12 months	320 – 580 mg per day
1 – 3 year olds	460 – 1730 mg per day

1000 mg sodium is contained in about 3 g of common salt, or just over half a teaspoon.

To achieve this intake, infants and children should consume fresh food, foods normally processed without salt, and low salt or no added salt, and avoid adding salt to food (10).

For infants, ingestion of foods high in sodium can lead to death because the kidneys are not fully developed until many months after birth. This is another reason why solids should not be introduced until 6 months of age. The new food standards code for Australia and New Zealand stipulates the total amount of sodium allowed in foods for infants is a maximum of 100 mg/100g in flours, pasta and ready to eat foods. However, in biscuits it is 300 mg/100 g and 350 mg/100 g to teething rusks. In comparison, the sodium content of breastmilk is 18 mg/100 g.

Food Standards Australia New Zealand defines a low salt food as a food with a sodium concentration of up to 12 mg/100 g.

4.6 Sugar in food

Many foods in the Australian diet contain naturally occurring sugars. In other foods, sugars may be added during processing to increase the food's palatability and acceptability and sometimes to add bulk. Sugars provide a readily absorbed source of energy and have an important role as sweeteners and flavour enhancers.

The presence of high amount of sugars can dilute the nutrient density of the diet, and diets high in added sugar have been associated with development of obesity and dental caries.

Taste buds detect four primary taste qualities: sweet, bitter, salt and sour. Children's preference for a majority of foods are influenced by learning and experience, they develop a preference in relation to the frequency and exposure to particular tastes. The only innate preference is for sweet, and even newborn infants will avidly consume sweet substances if given them. It is therefore important not to introduce sugar in any concentrated form until the infant has a chance to experience and develop a taste for other flavours, especially fruits and vegetables (5).



Parental resource



Food label poster

http://www.foodstandards.gov.au/_srcfiles/final%20FSANZPosterV2.pdf

4.7 Useful websites and resources

Queensland

Child Health Fact Sheets

www.health.qld.gov.au/child&youth/factsheets/

Community Child Health

www.health.qld.gov.au/cchs/nutrition.asp

Growing Strong: feeding you and your baby manual

www.health.qld.gov.au

Fun not Fuss with Food

- Order form for non QH staff

www.health.qld.gov.au/phs/Documents/sphun/27967.pdf

- Order form for QH staff

qhps.health.qld.gov.au/PHS/Documents/sphun/27966.pdf



Fact Sheets

qhps.health.qld.gov.au/PHS/Documents/sphun/27484.pdf

Royal Children's Hospital Health Service District Department of Nutrition and Dietetics – Infant and toddler feeding guide - Parent Information (2004). Hard copies available from Nutrition and Dietetic Department ph 07 3636 8571.

Royal Children's Hospital Health Service District – Community Child Health Service: Time to Eat – baby's first foods (2004). Health promotion and prevention issues, education document services cchs106, second edition. Ph 07 3250 8530 officer manager primary care program cost \$104.60 including GST plus postage.

Royal Children's Hospital Health Service District – Community Child Health Service: First Steps

qhps.health.qld.gov.au/rch/cchs/Resources/first_steps.pdf



New South Wales

Teach your baby to drink from a cup.

www.mhcs.health.nsw.gov.au



South Australia

Foods for babies (solids)

www.cyh.com/HealthTopics/HealthTopicDetails.aspx?p=114&np=302&id=1487

Foods for babies (solids) questions and answers

www.cyh.com/HealthTopics/HealthTopicDetails.aspx?p=114&np=302&id=1927

Nutrition topics

www.cyh.com/HealthTopics/HealthTopicCategories.aspx?p=302



Tasmania

TuckerTalk Manual (2003). Department of Health and Human Services Tasmania.
Ph 03 6222 7222



National

Raising Children Network

www.raisingchildren.net.au/nutrition/babies_nutrition.html

NHMRC

www.health.gov.au/nhmrc/publications



International

WHO

<http://www.who.int/child-adolescent-health/NUTRITION/infant.htm>

International Association of Infant Food Manufactures

www.ifm.net/sitemap.htm

Ellyn Satter

<http://www.ellynsatter.com/index.htm>

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