DEVELOPMENTAL STAGES IN INFANT AND TODDLER FEEDING

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LEARNING POINTS

1. Four key areas in the development of feeding are the acquisition of:
   - skills related to feeding and eating
   - specific feeding skills
   - taste, texture and food preferences
   - appetite regulation

2. General skills include facial expressions, holding and mouthing, imitating others’ behaviour and relating to others

3. Specific feeding skills include sucking, swallowing, chewing, biting, spoon-feeding and drinking from a cup

4. Taste, texture and food preferences develop as children learn to accept or reject certain food tastes and textures

5. Appetite regulation begins from birth but becomes more effective as the child learns to signal hunger and satiety

6. There is considerable variation in the ages at which infants and toddlers achieve new feeding skills due to:
   - differences in the rate of their physical and mental development
   - interaction with the environment
   - how often these skills are promoted by the parent
DEVELOPMENTAL STAGES IN INFANT AND TODDLER FEEDING

Parents often ask health professionals when their child can be expected to attain feeding and drinking related skills and acquire preferences for particular foods. They also want to know if it is 'normal' for their child to be reluctant to accept certain tastes, and which food textures they can cope with at what ages.

Feeding infants and toddlers can be an intense and emotional (positive and negative) experience for both parent and child. During the early years a child’s relationship with food, during milk-feeding, the introduction of complementary foods and the transition to family foods, can be critical for his or her health and development, and have long-term consequences.

This factsheet aims to provide health and childcare professionals with an evidence-based description of the developmental stages observed around food and feeding in infants and young children. The factsheet is divided into four sections, dealing with the development of:

- skills related to feeding and eating
- specific feeding skills
- taste, texture and food preferences
- appetite regulation

Key

The developmental stages are illustrated using the colour coding key below.
SKILLS RELATED TO FEEDING AND EATING

There are a number of general motor skills and behavioural changes which, while not specific to feeding, play an important part in the development of an infant's eating habits and ability to eat food and drink. Recognising the body language, facial expressions and physical behaviour of infants and toddlers can greatly assist parents and carers in feeding them.

MOTOR DEVELOPMENT AND COGNITIVE DEVELOPMENT OF FEEDING SKILLS

Holding and mouthing
From three months an infant can use both tongue and mouth to explore toys and by four months hold, mouth and look carefully at objects\(^1,2\). Objects cannot be picked up with a thumb and finger (pincer grasp) until about nine months of age\(^3\).

Sitting without support
About one-third of infants can sit alone without support between the ages of four to six months, and by nine to eleven months almost all infants (97 per cent) can do this\(^4,5\).

Pointing at objects
This can occur in infants as young as nine months, but most toddlers will begin to point by 14 months to show others what they want\(^6\), and from this age they may point at foods that they know or like.

Categorising objects by sight
Grouping foods into visual categories begins from about nine months of age\(^7\). For example, as children progress into their second year and move from local to global processing they begin to understand that a new, different-shaped biscuit might taste like a biscuit that they have had before.

Saying first words
Some infants say their first word at nine months, and most will have done so by eighteen months\(^8\). At first these words are not generalised, but context-specific; toddlers begin saying ‘no’, ‘more’ or naming a food that they want at mealtimes from around 12 months.
Newborn infants can signal their taste preference by facial expression. They will grimace in response to tastes they dislike, such as a bitter taste. Sweet foods do not elicit this adverse response9.

The ability to recognise different adult facial expressions is achieved by some infants between three and five months10. However, it is not until seven months that infants interpret emotional cues and prefer to look at a smiling rather than a frowning face11; and it is not until around ten months of age that most infants change their behaviour in response to different adult facial expressions12.

**INTERACTION WITH OTHERS**

Infants are interested in faces from birth, and by the age of four months will watch and understand turn-taking interactions with others13. They become attuned to the style of feeding that they have experienced. If mealtimes are stressful they can pick up on this at an early age.

**IMITATION OF OTHERS**

Newborn infants can show basic imitation of face and mouth movements from birth14. From soon after birth, they show motor movements in response to other peoples’ actions and these gradually become more like the movement that they are trying to copy. However, such imitation is still poor, even at six months of age3, and it takes many repetitions for infants to achieve good mimicry. Good imitation of adult behaviour develops through the second year of life15. 14-month old toddlers imitate eating behaviour and will try a new food if an adult tries it first. Toddlers start imitating other toddlers from around 24 months and children of three to four years of age will modify their food choices to be like those of other children with whom they are eating16,17,18.
SPECIFIC FEEDING SKILLS

While going through the general developmental stages described previously, young children also develop skills that are specific to feeding and eating. These are related to certain physiological adaptations that allow the child to cope with the changes of diet that occur through infancy, the introduction of complementary foods and the transition to family foods. These motor skills are mapped out to show when each is likely to develop. However, although these skills might be in place, complementary food should not be introduced until the 4 - 6 month introductory period, when the progression can be made to foods that require more complex oral motor processing.

ORAL MOTOR DEVELOPMENT (function of the lips, jaws and teeth)

**Sucking and swallowing**
Sucking and swallowing are observed in fetuses in the womb as early as 14 - 15 weeks gestation. The smooth co-ordination of sucking, breathing and swallowing develops in infants over the first few days of life19.

Newborn infants can only cope initially with sucking liquids because the space within the mouth is very small and tongue movement therefore limited. They can adapt their sucking response to adjust to different types of milk flow, e.g. milk from the breast or the bottle19. Newborn infants can open their mouth in readiness to suck their fist. This behaviour is more likely to happen if the infant is hungry20.

**The gag reflex**
The gag reflex in newborn infants is a protective reflex that prevents the ingestion of pieces of food that are too large to be comfortably swallowed20. Lumpy foods are best started early to promote good oral motor function, at around six months21,22. As the infant gets more used to foods and other textures in the mouth, the gag reflex usually declines. However, it can still be seen in infants of six months and older when they are given lumpy solid foods21. The gag reflex in response to solid textured foods gradually declines between the ages of six to twelve months, and is seen less often in infants who have begun to eat lumpy foods from an earlier age.

Lumpy solid foods are usually introduced between around five and 15 months1. Highly sensitive children, who find touch in the mouth uncomfortable may gag and then vomit as an aversive response to lumpy foods23. The gag response does not disappear completely; many adults gag in response to oral medication.

**Tongue control**
Moving food appropriately to the back of the mouth can be observed from as early as two months of age1. If pureed or smooth foods are introduced between four and six months, when the infant is learning to control the tongue, some tongue protrusion occurs which can look as if the infant is pushing the food out of the mouth. This does not mean the infant dislikes the food, but needs more practice with it in order to develop tongue control.

**Tongue movement**
A newborn infant can move the tongue up and down within the mouth, and in and out of the mouth, but the oral cavity is too small for anything other than liquid19. During sucking the tongue moves backwards and forwards, and up and down movements increase as sucking pads disappear and there is more space in the oral cavity. Foods that are more solid, with lumps in puree or mash, need either up and down or side to side tongue movements to process them. Side to side movement is triggered by food in the mouth, and depends on the age at which lumpy solid foods are introduced.

**Opening mouth in response to spoon**
This response is usually seen in infants from four months of age, although it has been reported in infants as young as two weeks and as old as nine months of age1.

**Clearing spoon with top lip**
This usually happens from around seven months of age, and spoon-feeding before this age may require the parent to wipe the food from the spoon onto the infant’s top lip1. 77 per cent of infants clear the spoon by eight months, and 97 per cent by 24 months2.
Chewing foods
Chewing requires a combination of lip, tongue and jaw movement. From around six months, after the introduction of lumpy solids, infants can co-ordinate all of their mouth movements; sucking, biting, and up and down munching. This early chewing can develop before the teeth have erupted as the gums are hard from the teeth within them.

Chewing efficiency develops in response to different textured foods being offered, and most infants can cope with lumpy textured foods between six months and one year. Infants who are introduced to these more solid textured foods at around six months will be chewing effectively by twelve months of age and able at two years to cope with most foods which are offered to them as part of a family meal.

Biting food
The first tooth usually appears at around six months, but may erupt earlier or later. All milk (or first) teeth are usually present by the age of three years. The first teeth are usually the lower front teeth (incisors - at six to ten months), followed by the upper front teeth (eight to 12 months). The side teeth (molars) do not usually appear before the end of the first year.

Infants can bite hard textured foods, such as a cracker, from the age of around eight months. However, biting into hard food, such as a piece of raw apple, only begins when both upper and lower front teeth (incisors) have erupted.

SELF FEEDING

4-11 months
Starts to hold food and bring food to the mouth

8 months
8 months - 2 years
8 months - 2 years
11 months - 2 years
15 months

8 months
Begins to try to feed from spoon without spilling from eight months

8 months - 2 years
Begins to drink from closed cup (by 11 months, most infants can drink from a closed cup)

11 months - 2 years
Begins to drink from open cup (by 19 months, most infants can drink from an open cup)

15 months
Most infants can feed themselves with a spoon

Holding food
Most infants can feed themselves with food held in their hands by the age of eight months. They will begin to try to feed themselves from a spoon without spilling between eight months and two years. Most infants can feed themselves from a spoon quite well at about 15 - 18 months.

Drinking from cups
Most infants can sip liquids from a closed cup by themselves by eleven months. Infants can however sip from a closed cup with help from a carer from a much earlier age. Few infants can drink from an open cup until they are over 19 months of age.

GENERAL PHYSIOLOGY

The general and specific feeding skills described above occur together with the development of the gut and kidneys, which are involved in the digestion and absorption of food and the excretion of waste products in the urine.

Digestion and absorption
The gut enzymes needed to digest solid foods develop in infancy, well before they are required to digest non-milk starch, proteins and fats. Young infants fed on non-milk foods can therefore digest these foods. Infants and toddlers have smaller stomachs than adults and need smaller portions of food.

Defence (immune) system
Breast milk contains numerous protective factors that help to defend infants from the effects of bacteria and other harmful substances in the diet. The infant’s own immune system develops after birth, and during early life mother’s milk can help combat some childhood infections.

Renal (kidney) function
The ability of the kidneys to excrete large amounts of minerals and salts is limited in early infancy, but adequately developed by four and six months to cope with complementary foods which contain higher levels of minerals and salt.

Introduction of complementary foods
The Department of Health recommends that infants should first be given foods other than breast milk at around six months of age. In developed countries it is safe to introduce complementary foods by the age of six months but not before four months. The European guidelines for the introduction of solid/complementary foods is between four and six months. A survey carried out in the UK in 2011 reported that approximately 80 per cent of infants had been given their first foods by the age of five months.
**TASTE, TEXTURE AND FOOD PREFERENCES**

Growing infants and young children not only adapt physically and mentally to the challenges of eating, but also develop taste, texture and food preferences that have a significant impact on the types of foods they are willing to eat. These preferences (and aversions) can often persist into adolescence and beyond. Taste and food preferences are subject to a number of influences described below:

**ACCEPTANCE AND REJECTION**

![Image](image1.jpg)

**Before birth**
Some infants will inherit a strong dislike of bitter tastes and certain food textures. Some may be more neophobic than others and reject more foods when older. All infants are born with a sweet taste preference.

**Birth - 6 months**
Some strong taste preferences learned from the taste of milk feed.

**Birth**
Preference for strong tastes such as garlic and spices learned from exposure to amniotic fluid.
Preference for energy dense sweet and fat foods (continues through childhood).

**14 months**
Rejection of food begins.

**20 months - 8 years**
Neophobic response.

**4 - 6 months**
Introduction of complementary foods.
Taste preferences rapidly learned and easier acceptance of new foods.
It is better to introduce a wide range of tastes in this period.

**2 years**
Preferences now predict food preferences throughout life.

**Inborn preferences**
Infants have a preference for energy-rich foods. They are born with a preference for sweet tastes; all other taste preferences are learned through experience. However, even this sweet taste preference is modified by subsequent experience of food and drinks.

**Learned preferences before birth**
Taste preferences can be acquired by an infant from his or her pregnant mother via the amniotic fluid which has been flavoured by the foods she has eaten.

**Breast feeding**
The foods eaten by a breast-feeding mother can influence the infant’s taste preferences at the introduction of complementary foods. Her milk can be flavoured by the food she eats, e.g. garlic. However, this does not happen with all foods and all tastes.

**Inherited factors**
Some infants, toddlers and adults are particularly sensitive to the taste of bitter foods and drinks. Unfortunately many vegetables that contribute to a healthy, varied diet have a bitter aftertaste.

**Learned taste acceptance**
Infant taste preferences are learned through experience. However, the earlier infants are offered food with a specific strong taste, such as vegetables, the more likely they are to accept the food. They are also more likely to accept other new foods and new tastes if these are given earlier in the period of introduction of complementary foods.

**Disgust and rejection**
By the end of the first year infants have learned to recognise by sight which foods they do not like. For some children the disgust-response to disliked foods starts from around 14 months. Disliked foods might be rejected on sight, and disliked foods that are touching or hidden under liked foods may lead to all of the meal being rejected.

**Neophobic stage – the fear of new foods**
It is relatively easy to introduce new foods to infants before the age of one year. However, after this, toddlers are often very reluctant to accept new foods and often refuse to eat foods that they accepted before. This rejection of new foods is a normal response which peaks at about the age of 20 months, before gradually diminishing by the age of about eight years. Children with neophobic parents are more likely to be neophobic themselves.

See Factsheet 2.1

See Factsheet 2.3
TEXTURE PROGRESSION

4-6 months
Can cope with pureed and mashed food

6 months onwards
Introduction of lumpy solids
Mash with soft lumps
Bite and dissolve
Soft chew

8 months
Can cope with mash with harder lumpy solids
Begins to chew (most can chew without gagging at 12 months)

Sensory sensitivity and neophobia
The neophobic stage, which peaks at about 20 months, is stronger in some toddlers than others. Toddlers who are sensory-sensitive are more likely to refuse new foods. Some toddlers at this age will also show a disgust and contamination response. They not only refuse to eat food that they do not like, but also reject food that has been touched by the disliked food. See Factsheet 2.1

EATING PREFERENCES, SMELLS AND TASTES

Birth
Shows preference for known tastes and smells

4 months
Learns to like and accept complementary foods quite quickly and with variety

9 months
Can begin to understand that similar looking foods might taste the same

9-14 months
Points to food they know they like

14-16 months
Imitates adult’s eating preferences

3 years
Imitates age-mate’s eating behaviour

4 years
The range of foods in a young child’s diet predicts late child and adult dietary range

Newborn infants recognise faces, sounds, smells and known tastes from birth. Soon after birth infants will rapidly recognise the tastes and smells of milks and in later infancy foods which they have previously experienced.

At four months infants can recognise food by taste and smell and quickly learn to accept a variety of new foods offered to them. At 14 months they will imitate the eating behaviour of adults. The variety of foods accepted by an infant gradually increases until around two years and then remains fairly constant until around eight years. The range of foods in a young child’s diet predicts their food choices and preferences in adulthood.
APPETITE REGULATION

The ability to regulate food intake in response to nutritional need is a vital part of feeding and eating. It depends on innate and acquired processes, including the capacity to respond to physiological signals of energy (calorie) intake and demand, and the ability to signal to whoever is controlling the mealtime.

SIGNALLING HUNGER

The newborn infant can turn the head, root for the nipple and cry when hungry. Infants of around four months of age show renewed night waking, when previously they had slept through the night, and fist sucking between feeds, which mothers interpreted as hunger.

When complementary foods are introduced (ideally not later than six months, but often from around four months), the infant will open his or her mouth in response to food and move toward the spoon. Similarly from about four months the infant can grasp food and start to put food from the hand into the mouth - the start of self-feeding.

As infants get older and more used to food, they will become excited when they see it prepared and try to take food that others are eating.

SIGNALLING SATIETY AND DISLIKE

Infants can signal to parents that they no longer want food or milk.

Milk-fed infants can show that they have had enough by:

- stopping sucking
- spitting out the nipple or teat and turning their head away
- slowing down feeding pace

Complementary fed infants can show that they have had enough by:

- turning head away from the spoon
- clenching mouth shut
- spitting food out
- holding food in the mouth

- showing a disgust facial response
- blocking the mouth with the hand
- crying

Older infants will:

- throw food
- signal ‘no’ in response to unwanted food given to them

Toddlers may try to:

- distract their parent
- become distracted
- move away from the meal table

See Factsheet 2.2
Partial regulation
The amount of milk the infant takes from the breast is controlled largely by the infant, who can regulate his or her energy intake from soon after birth. At first this regulation is only partial but as the infant gets older it improves.

Good regulation
From the age of four to six months infants can adjust their energy intake when complementary foods are offered to ensure they do not take in more food and milk than they need. If parents follow their infant’s hunger and satiety cues whilst giving complementary foods, the infant will be more likely to have a lower BMI as a toddler than those whose parents use non-responsive feeding practices and do not respond to infant signals of satiety.

Prompting
Some young children (3 - 6 years) will respond to prompts to eat more by finishing what is on their plate, but this is only true of children who like to copy others’ eating behaviour. It can lead to overeating in an overweight child. However, for some fussier children repeated prompts or pressure to eat can lead to a reduction in food intake; mealtimes become uncomfortable for the child.

Portion size
Children from two years old will eat more food if given larger portions. But if ‘treat’ foods are restricted then pre-school children will eat more of these foods when they become available.

See Factsheet 3.3