

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.

Birth - 1 month	1 month - 3 months	3 months - 6 months	6 months - 12 months	12 months - 2 years	2 years and above
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Developmental milestones can be helpful markers of typical child development and used to reassure parents about their child's development. However, the age at which infants achieve many motor skills is dependent on how often they are promoted by the parent and performed by the child. This means that there is variation in the ages at which an infant or toddler will achieve a new skill, determined by his or her innate abilities and interaction with the environment.



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

Birth

Brings hand to mouth and opens mouth in preparation to suck



3 months

Holds onto objects and puts them into the mouth



4-11 months

Begins to sit with some support and then unaided



9-18 months

Says first words, context specific, might say word for known food

12 months

Recognises food by sight, smell and taste

Communicates using words to ask for or name foods that they might want

2 months

Holds objects

4 months

Holds, mouths and shows visual exploration of objects

9 months

Pincer grasp with finger and thumb

Sits without support



12 months and beyond

Visually groups food into categories

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 age³.

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 want⁶, 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 age⁷. 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 months⁸. 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.

FACIAL EXPRESSION

Birth Indicates likes and dislikes 	3-5 months Tells the difference between others' expressions of pleasure and disgust 	7 months Prefers a smile to a frown 	10 months Uses facial expressions (of others) as a cue to change behaviour 
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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

Birth Prefers to look at faces 	4 months Watches and responds appropriately to a sequence of events in interactions with others 
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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

Birth Imitates adult facial expression Opens mouth in response to adult open mouth 	4-6 months Some imitation of movements and facial expression 	6 months-2 years Shows deferred imitation of action which is not context specific 	2 years Imitates other toddlers' behaviour 
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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 eating^{16,17,18}.

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)

Before birth Sucking observed in the womb Swallowing observed in the womb 	2 weeks - 9 months Can show open mouth for spoon at an early age so this response is present before onset of complementary feeding at 4 - 6 months	6 - 12 months Eruption of front teeth 	8 - 12 months Can bite into harder foods when teeth have erupted 
Birth Opens mouth to suck fist especially if hungry The gag response to food and objects in the mouth is observed from birth Moves tongue in and out, and up and down	2 months Can move food from a spoon to the back of the mouth	6 - 14 months Can chew softer lumps and keep most food in the mouth	12 months - 4 years Can cope with most textures offered but chewing not fully mature
	6 months Gag response declines as mouth becomes more used to the feel of food; but still observed in most adults Can move food from side to side of the mouth (from introduction of lumpy solids)	7 - 12 months Can close the lips to clear the spoon 	2 years Can cope with most foods offered as part of a family meal

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 months^{21,22}. 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 months⁵.

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 munching²⁴. 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 year²¹. 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 meal²⁵.

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. [See Factsheet 4.5](#)

Infants can bite hard textured foods, such as a cracker, from the age of around eight months¹. 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

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 months⁵. 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 months⁵.

Drinking from cups

Most infants can sip liquids from a closed cup by themselves by eleven months⁵. 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 fats²⁶. 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.

[See Factsheets 1.1 and 1.3](#)

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 infections²⁶.

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 salt²⁷.

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 months²⁸. 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 months²⁹.

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 beyond³⁰. Taste and food preferences are subject to a number of influences described below:

ACCEPTANCE AND REJECTION

Before birth

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

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)



Birth-6 months

Some strong taste preferences learned from the taste of milk feed

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



14 months

Rejection of food begins

20 months-8 years

Neophobic response

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 experience³¹. 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 eaten³².

Breast feeding

The foods eaten by a breast-feeding mother can influence the infant's taste preferences at the introduction of complementary foods³². Her milk can be flavoured by the food she eats, e.g. garlic. However, this does not happen with all foods and all tastes³³.

Inherited factors

Some infants, toddlers and adults are particularly sensitive to the taste of bitter foods and drinks³⁴. Unfortunately many vegetables that contribute to a healthy, varied diet have a bitter aftertaste.

See Factsheet 2.1

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^{35,36}. 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^{37,38,39}.



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 months⁴⁰. 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 before⁴¹. 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 years⁴². Children with neophobic parents are more likely to be neophobic themselves⁴³. 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)



Complementary foods with a soft lumpy texture should be introduced as soon as possible at around six months of age. If lumpy solid foods are not introduced until late in the first year, those foods are more likely to be refused and the infant is more likely to have feeding problems during his or her second year^{44,45}. Late introduction of lumpy solid foods is also related to poorer acceptance of fruit and vegetables in later childhood^{46,47}. Some children and adults show an inherited tendency to avoid certain foods, such as fish, meat and vegetables⁴⁸. These foods may be rejected because of their texture. Those who tend to reject foods because of their texture are more likely to be sensory sensitive.

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 foods⁴⁹. 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 food⁴⁰.

See Factsheet 2.1

EATING PREFERENCES, SMELLS AND TASTES

Birth

Shows preference for known tastes and smells



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



4 months

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



Newborn infants recognise faces⁵⁰, sounds, smells and known tastes from birth. Soon after birth infants will rapidly recognise the tastes and smells of milks⁵¹ and in later infancy foods which they have previously experienced⁵².

At four months infants can recognise food by taste and smell and quickly learn to accept a variety of new foods offered to them⁵³. At 14 months they will imitate the eating behaviour of adults⁵⁴. The variety of foods accepted by an infant gradually increases until around two years and then remains fairly constant until around eight years⁴². The range of foods in a young child's diet predicts their food choices and preferences in adulthood⁵⁵.

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

Birth

Roots and turns in search of nipple
Sucks fist



4 months

Opens mouth for food
Moves head towards spoon with mouth open
Watches food
Reaches for food



9 months

Clear interest in feeding self
Points to food



12 months

Says the word for food they want



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 hunger⁵⁶.

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-feeding⁵. 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

Birth

Cries and turns head away from nipple
Sucks slowly and stops sucking
Pushes nipple from mouth
Facial expression



4 months

Turns away from spoon
Shows disgust/gags at disliked food



12 months

Throws food
Signals or says 'no' to unwanted/disliked food
Distracted by toys during mealtimes



14 months

Moves away from meal or meal table

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.^{40,57,58}

See Factsheet 2.2

REGULATION OF APPETITE

Birth

Can reject a milk feed
Partial regulation of calorie intake



2 months

Good regulation of intake according to internal cues

4-6 months

Shows regulation of intake of breast milk and complementary foods
Responds to stressful mealtime interactions by refusing food
Shows preference for and rejection of foods
Shows better regulation with responsive feeding

14 months

Imitates adult eating



24 months

Imitates other children
Eats more in response to portion size

36 months

Responds to prompts to overeat - but only in some children
Reduces amount eaten when pressured
Changes food preferences to be like age-mates
Shows preference for restricted/ withheld foods

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 birth⁵⁹. 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 need⁶⁰. 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 satiety⁶¹.

See Factsheet 3.3

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 child⁶². However, for some fussier children repeated prompts or pressure to eat can lead to a reduction in food intake; mealtimes become uncomfortable for the child⁶³.

Portion size

Children from two years old will eat more food if given larger portions⁶⁴. But if 'treat' foods are restricted then pre-school children will eat more of these foods when they become available⁶⁵.



References

- Carruth BR, Skinner JD. Feeding behaviors and other motor development in healthy children (2-24 months). *J Am Coll Nutr*. 2002 Apr;21(2):88-96
- Rochat P. Mouthing and grasping in neonates; evidence for the early detection of what hard or soft substances afford for action. *Infant Behav Dev*. 1987 10:435-49.
- Bremner. *Infancy. Oxford: Blackwell*; 1994
- Rochat P, Goubet N. Development of sitting and reaching in five to six month old infants. *Infant Behav Dev*. 1995;18(1):53-68
- Carruth BR, Ziegler PJ, Gordon A, et al. Developmental milestones and self-feeding behaviors in infants and toddlers. *J Am Diet Assoc*. 2004 Jan;104(1 Suppl 1):s51-56
- Schaffer HR. The child's entry into a social world. London, Academic Press 1984
- McDonough L, Mandler JM. Inductive generalization in 9 and 11-month-olds. *Dev Sci*. 1998;1(2):227-32
- Fenson L, Dale PS, Reznick JS, Bates E, et al. Variability in early communicative development. *Monogr Soc Res Child Dev*. 1994;59(5):1-173; 17
- Rosenstein D, Oster H. Differential facial responses to four basic tastes in newborns. *Child Dev*. 1988 Dec;59(6):1555-68
- Nelson CA. The recognition of facial expressions in the first two years of life: mechanisms of development. *Child Dev*. 1987 Aug;58(4):889-909
- Soken NH, Pick AD. Infants' perception of dynamic affective expressions: do infants distinguish specific expressions? *Child Dev*. 1999 Dec;70 (6):1275-82
- Walden TA, Ogan TA. The development of social referencing. *Child Dev*. 1988 Oct;59(5):1230-40
- Rochat P, Querido JG, Striano T. Emerging sensitivity to the timing and structure of protoconversation in early infancy. *Cognitive Development*. 1999. 12 (4) 441-465
- Meltzoff AN, Moore MK. Newborn infants imitate adult facial gestures. *Child Dev*. 1983 Jun;54(3):702-9
- Jones SS. Imitation in infancy: the development of mimicry. *Psychol Sci*. 2007 July ;18(7):593-9.
- Seehagen S, Herbert JS. Infant Imitation From Televised Peer and Adult Models. *Infancy*. 2011;16(2):113-36
- Birch LL, Gunder L, Grimm-Thomas K, et al. Infants' consumption of a new food enhances acceptance of similar foods. *Appetite*. 1998 June ;30(3):283-95
- Hendy HM. Effectiveness of trained peer models to encourage food acceptance in preschool children. *Appetite*. 2002 Dec;39(3):217-25
- Wolf L, Glass R. Feeding and swallowing disorders in infancy. *Therapy Skill Builders*. Tucson, Arizona; 1992
- Blass EM, Fillion TJ, Rochat P, et al. Sensorimotor and motivational determinants of hand-mouth coordination in 1-3-day-old human infants. *Dev Psychol*. 1989;25(6):963-75
- Gisel EG. Effect of food texture on the development of chewing of children between six months and two years of age. *Dev Med Child Neurol*. 1991 Jan;33(1):69-79
- Reilly S, Skuse D, Mathisen B, et al. The objective rating of oral-motor functions during feeding. *Dysphagia*. 1995;10(3):177-91
- Harris G. Food refusal in the sensory-sensitive child. *Paediatr Child Health*. 2009 Sep;19(9):435-6
- Wilson EM, Green JR. The development of jaw motion for mastication. *Early Hum Dev*. 2009 May;85(5):303-11
- Wilson EM, Green JR, Weismer G. A kinematic description of the temporal characteristics of jaw motion for early chewing: preliminary findings. *J Speech Lang Hear Res JSLHR*. 2012 Apr;55(2):626-38
- McClean P, Weaver LT. Ontogeny of human pancreatic exocrine function. *Archives of Disease in Childhood*. 1993; 68:62-5. Available at: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1029173/pdf/archdisch00545-0062.pdf> Last accessed 10.07.14
- Fomon SJ. Water and renal solute load. In: Fomon SJ. Nutrition of Normal Infants. St Louis, MO, Mosby 1993
- Agostoni C, Braegger C, Decsi T, et al. Breast-feeding: A commentary by the ESPGHAN Committee on Nutrition. *J Pediatr Gastroenterol Nutr*. 2009 Jul;49(1):112-25
- Department of Health. Diet and nutrition survey of infants and young children. 2011. Available at: <http://webarchive.nationalarchives.gov.uk/20130402145952/http://transparency.dh.gov.uk/2013/03/13/dnsiyc-2011/> Last accessed 10.07.14
- Batsell WR, Brown AS, Ansfield ME et al. "You will eat all of that!" A retrospective analysis of forced consumption episodes. *Appetite*. 2002, 38 (3) 211-219
- Schwartz C, Issanchou S, Nicklaus S. Developmental changes in the acceptance of the five basic tastes in the first year of life. *Br J Nutr*. 2009 Nov;102(9):1375-85
- Mennella JA, Jagnow CP, Beauchamp GK. Prenatal and postnatal flavor learning by human infants. *Pediatrics*. 2001 Jun;107(6):E88
- Sullivan SA, Birch LL. *Pediatrics*. 93. Infant Dietary Experience and Acceptance of Solid Foods; 1994. p. 271-277
- Bell KI, Tepper BJ. Short-term vegetable intake by young children classified by 6-n-propylthiouracil bitter-taste phenotype. *Am J Clin Nutr*. 2006 Jul;84(1):245-51
- Schwartz C, Chabanet C, Lange C, et al. The role of taste in food acceptance at the beginning of complementary feeding. *Physiol Behav*. 2011 Sep 26;104(4):646-52
- Harris G, Thomas A, Booth DA. Development of salt taste in infancy. *Developmental Psychology*. 1990, 26, 4, 534-538
- Lange C, Visalli M, Jacob S et al. Maternal feeding practices during the first year and their impact on infants' acceptance of complementary food. *Food Quality and Preference*, 2013, 29(2), 89-98
- Nicklaus S. Children's acceptance of new foods at weaning. Role of practices of weaning and of food sensory properties. *Appetite*. 2011 Dec;57(3):812-5
- Couthard H, Harris G, Fogel A. Exposure to vegetable variety in infants weaned at different ages. *Appetite*. 2014;78,89-94
- Brown SD, Harris G. Disliked food acting as a contaminant during infancy. A disgust based motivation for rejection. *Appetite*. 2012 Apr;58(2):535-8
- Brown SD, Harris G. The rejection of previously accepted foods in toddlers: An extension of the neophobic response? *Int J Child Health Nutr*. 2012;1(1):72-81
- Nicklaus S. Development of food variety in children. *Appetite*. 2009 Feb;52(1):253-5
- Cooke LJ, Haworth CMA, Wardle J. Genetic and environmental influences on children's food neophobia. *Am J Clin Nutr*. 2007 Aug;86(2):428-33
- Northstone K, Emmett P, Nethersole F. The effect of age of introduction to lumpy solids on foods eaten and reported feeding difficulties at 6 and 15 months. *J Hum Nutr Diet*. 2001 Feb;14(1):43-54
- Mason SJ, Harris G, Blissett J. Tube feeding in infancy: implications for the development of normal eating and drinking skills. *Dysphagia*. 2005;20(1):46-61
- Ahern SM, Caton SJ, Bouhassira D, et al. Eating a rainbow. Introducing vegetables in the first years of life in 3 European countries. *Appetite*. 2013, Dec;71:48-56
- Coulthard H, Harris G, Emmett P. Delayed introduction of lumpy foods to children during the complementary feeding period affects child's food acceptance and feeding at 7 years of age. *Matern Child Nutr*. 2009 Jan;5(1):75-85
- Breen FM, Plomin R, Wardle J. Heritability of food preferences in young children. *Physiol Behav*. 2006;88:443-447
- Farrow CV, Coulthard H. Relationships between sensory sensitivity, anxiety and selective eating in children. *Appetite*. 2012 Jun;58(3):842-6
- Pascalis O, de Schonen S, Morton J, et al. mothers face recognition by neonate: a replication and an extension. *Infant Behaviour and Development*. 1995; (18) 79 - 85
- Cernoch JM, Porter RH. Recognition of maternal axillary odors by infants. *Child Dev*. 1985 Dec;56(6):1593-8
- Harris G, Booth D A. Infants' preference for salt in food: its dependence upon recent dietary experience. *Journal of Infant and Reproductive Psychology*. 1987 5; 97-104
- Maier A, Chabanet C, Schall B, et al. Breastfeeding experience with variety early in weaning increase infants' acceptance of new foods for up to two months. *Clinical Nutrition*. 2008. 27, 849-857
- Harper L, Sanders K. The effect of adults' eating on young children's acceptance of unfamiliar foods. *Journal of Experimental Child Psychology*. 1975, 20, 206-14
- Nicklaus S, Boggio V, Chabane C, et al. A prospective study of food preferences in childhood. *Food Qual Pref*. (2004)15, 805-18
- Harris G. Determinants of the introduction of solid food. *Journal of Reproductive and Infant Psychology*. 1998 6; 241-249
- Powell F, Farrow C, Meyer C. Food avoidance behaviours in children. The influence of maternal feeding practices and behaviours. 2011, *Appetite*, 57, 3, 683-92
- Lindberg L, Bohlin G, Hagekull B, et al. Interactions between mothers and infants showing food refusal. *Infant Mental Health Journal*. 1996, 17(4),334-347
- Fomon SJ, Filmer LJ Jr, Thomas LM et al. Influence of formula concentration on caloric intake and growth of normal infants. *Acta Paediatr Scand*. 1975 Mar;64(2):172-81
- Cohen RJ, Brown KH, Canahuati J, et al. Effects of age of introduction of complementary foods on infant breast milk intake, total energy intake, and growth: a randomised intervention study in Honduras. *Lancet*. 1994 Jul 30;344(8918):288-93
- Daniels LA, Mallan KM, Battistutta D, et al. Evaluation of an intervention to promote protective infant feeding practices to prevent childhood obesity: outcomes of the NOURISH RCT at 14 months of age and 6 months post the first of two intervention modules. *Int J Obes*. 2012 Oct;36(10):1292-8
- Lumeng JC, Burke LM. Maternal prompts to eat, child compliance, and mother and child weight status. *J Pediatr*. 2006; 149:330-335
- Galloway AT, Fiorito LM, Francis LA, et al. "Finish your soup": counterproductive effects of pressuring children to eat on intake and effect. *Appetite*. 2006;46:318-323
- Fisher JO. Effects of age on children's intake of large and self-selected food portions. *Obesity*. 2007; 15:403-412
- Faith MS, Scanlon KS, Birch LL, et al. Parent-Child Feeding Strategies and their Relationships to Child Eating and Weight Status. *Obesity Research*. 2004;12 (11):1711-1722

For personalised analysis of toddlers' food intake and activity levels, use the Infant & Toddler Forum's Tot It Up app www.infantandtoddlerforum.org/toddler-food-calculator

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Supported by an unrestricted educational grant from Danone Nutricia Early Life Nutrition