Introduction to Complementary Foods

Introduction

The purpose of the Introduction to Complementary Foods Nutrition Guideline is to provide health professionals with an overview of the evidence-based nutrition recommendations on the introduction of complementary foods for healthy infants, both term and preterm (unless otherwise specified) and to provide answers to commonly asked questions. See the Key Questions List of this Nutrition Guideline (NG).

While comprehensive, this NG will not include detailed information specific to medical considerations requiring individual assessment of readiness to begin complementary feeding. In these situations, the infant may benefit from further assessment by an occupational therapist (OT), speech language pathologist (SLP), physiotherapist (PT), physician and/or registered dietitian (RD).

This information is intended as a general resource only and is not meant to replace the medical counsel of a physician or individual consultation with an RD. It is the responsibility of the health professional to evaluate the situation of each patient in their care and apply the NG appropriately. Individuals who are at high risk of malnutrition or who have a medical condition that is impacted by nutrition should receive RD intervention.

Referral to a Registered Dietitian

To refer a patient to a registered dietitian Alberta Health Services (AHS), visit Referring Patients for Nutrition Services.

Background

This NG was developed by dietitians from the Nutrition Services 0–6 Target Population Provincial Working Group and is based on scientific evidence, best practice, and expert opinion.

Key Recommendations

- For term infants:
  - Exclusively feed breastmilk until around six months of age. At this time, introduce nutrient-rich complementary foods while continuing to feed breastmilk until 24 months of age or longer. If needed, use infant formula in conjunction with or instead of breastmilk until 9 to 12 months of age.
- For preterm infants:
  - Exclusively feed breastmilk until 4 to 6 months of corrected age. At this time, introduce nutrient-rich complementary foods while continuing to feed breastmilk until 24 months corrected age or longer. If needed, use infant formula in conjunction with or instead of breastmilk until 12 months of corrected age.
- Introduce iron-rich foods as the first complementary foods to prevent iron deficiency. As complementary feeding progresses, offer an iron-containing food each time complementary foods are offered.
- Intentionally introduce commonly allergenic foods, prioritizing peanuts and eggs, to both term and preterm infants when starting complementary foods. If tolerated, continue to offer commonly allergenic foods regularly to maintain tolerance.
- Introduce only one commonly allergenic food per day to help identify the offending food if an allergic reaction occurs. For all other foods, there is no limit on how many new foods can be offered at one time. Introduce other foods from Canada's food guide alongside iron-containing foods and commonly allergenic foods.
- Small amounts of water can be offered at around six months with the introduction of complementary foods. Water should not replace breastmilk or breastmilk substitutes in the first year.
- Milk containing 3.25% fat may be introduced as a breastmilk substitute to term infants to completely or partially replace infant formula and/or breastmilk between 9 and 12 months of age and continued throughout the second year. Preterm infants should not receive 3.25% milk as a breastmilk substitute until they are 12 months corrected age. Plant-based beverages are inappropriate breastmilk substitutes. Animal milk and/or plant-based beverages can be introduced as ingredients in complementary foods around six months of age; however, these fluids should not replace breastmilk or breastmilk substitutes in the first year.

- Practice responsive feeding when offering complementary foods to support development, responding appropriately to an infant's hunger and fullness cues and allowing an infant to guide feedings. Start offering complementary foods once a day in small amounts and as an infant gets older, gradually increase the amount and frequency based on an infant's hunger and fullness cues. Offer complementary foods with breastmilk or formula feedings, or in between.
- Use a responsive feeding approach to gradually increase food consistency over the complementary feeding period in response to an infant's developing oral-motor skills. Infants are typically able to manage moderately thick, smooth textures around 6 months of age and advance to safely eat thicker, lumpier textures and soft and tender pieces of food within the first year.
- Offer a variety of family foods, modified into a texture an infant can successfully manage to expose an infant to traditional and cultural foods with a variety of textures and flavours.
- Foods marketed for infants can be an appropriate choice. If these are chosen, ensure family foods are also offered to provide an adequate variety of textures and flavours.

Considerations

In all circumstances, health professionals shall utilize client- and family-centred care to be responsive to the self-identified gender, pronouns, and terminology of the guardians and families they support.[1]

For this NG:

- The term 'parent' will be used to indicate parents, caregivers, or other persons caring for a child in the context of the family unit.
- The term 'breastmilk' will be used to indicate milk produced by human mammary glands.[2]
- 'Infant formula' will be used when referring to commercial infant formulas available on the Canadian market, unless otherwise specified.
- The term '3.25% milk' will be used when referring to pasteurized 3.25% (homogenized) cow's or fortified whole goat's milk.

Please note that if specific recommendations for preterm infants are not included it indicates sufficient evidence was unavailable.

Household Food Insecurity

Household food insecurity (HFI) is defined as "an inadequate or insecure access to food because of financial constraints";[3] it impacts physical, mental and social well-being. Health professionals will encounter parents of infants and children living in food-insecure households.[4]

HFI is best addressed through income-based interventions.[5–7] Those experiencing HFI have food preparation, budgeting, and cooking skills similar to the general population.[8] Interventions focused on food skills do not protect people from, nor improve HFI.[8] Emergency food programs (e.g. food banks) may provide temporary relief.[9] However, these programs do not solve HFI and are inappropriate and/or inaccessible for many patients.[9]

Infant formula may be difficult to obtain for those experiencing HFI due to access, availability, or cost. For families who are formula feeding, ensure they are accessing funding for formula, if eligible. Review the PEAS Formula Coverage webpage and the Point of Care Reference document: Funding Options for Special Diets and Nutrition Products for additional information on health benefits/special diet options for different infant formulas.

Health professionals can offer better support if they are aware of when parents are worried about having enough money for food and are experiencing other challenges because of financial strain.[10,11] Health professionals are encouraged to work with patients to develop interventions that are sensitive to financial strain.

Key steps for health professionals include:

- Learn about financial strain, how to screen patients for poverty, and the link between poverty and poorer health through the **Identifying Financial Strain and Addressing Financial Barriers to Health Care Modules**; available on MyLearningLink for AHS staff and on CLiC for Covenant Health staff.
- Review the Nutrition Guideline: Household Food Insecurity for additional information on how to support families experiencing HFI.
- Assist patients in accessing available income supports. The provincial directory 211 (ab.211.ca) can be used to identify financial benefits, programs, and services.
- Additional income support may exist for individuals during the early postpartum period. Advise clients receiving income support to connect with their support worker as they may qualify for additional money (supplementary benefits) to meet particular needs. For example, special diet funding is available for eligible individuals who are lactating or require infant formula for their infant. A lactating individual may be able to receive vitamins, food, food coupons, and/or nutrition counselling from the Alberta Canada Prenatal Nutrition Program (CPNP).

Definitions

Baby-led weaning: an approach to weaning in which an infant directs and controls the process, and feeds themself from the beginning of complementary feeding, first with their hands and later with cutlery.[12]

Choking (food-related): a piece of food partially or completely blocking the airway, affecting breathing.[13]

Complementary feeding: is the process that starts when human milk or infant formula is complemented by other foods and beverages, beginning during infancy and typically continuing until 24 months of age.[14]

Complementary foods: foods and beverages (liquids, semisolids, and solids) other than breastmilk or infant formula provided to an infant or young child to provide nutrients and energy.[14]

Corrected age (weeks or months): for preterm infants (less than 37 weeks, 0 days gestation), the age of the infant from birth minus the number of weeks born before 40 weeks of gestation.[15,16]

Developmental readiness: the physiological maturation necessary for an infant to metabolize complementary foods and the developmental changes necessary for safe and effective progression of feeding (e.g. suckling to spoon- to self-feeding).[17]

Gag reflex: a normal defence mechanism that prevents foreign bodies from entering the trachea, pharynx, or larynx. Unwanted, irritating, or toxic material is ejected from the upper respiratory tract by the contraction of the oropharyngeal muscles.[18]

Gestational age (completed weeks)**:** the time elapsed between the first day of the last normal menstrual period and the day of delivery.[15]

Iron-containing food: a food that contains greater than or equal to 5% of the daily value of iron per serving of stated size or reference amount. This is the criteria that allow food to carry a mineral content claim.[19]

Iron-rich food: a food that contains greater than or equal to 25% of the daily value of iron per serving of stated size or reference amount.[20]

Preterm infant: born at less than 37 weeks, 0 days gestation.[16]

Responsive feeding: an approach where caregivers encourage the child to eat autonomously and in response to their physiological and developmental needs, which may promote eating self-regulation and support cognitive, emotional, and social development.[21]

Small-for-gestational age (SGA): an infant's weight-for-gestational age at birth plotting less than the 10th percentile.[22]

The tongue extrusion or protrusion reflex: an automatic response in infants to force the tongue outward when the lips are touched.[23] This reflex is present at birth to coordinate suckling, swallowing and respiration, and protect the infant from aspiration and choking.[17]

Weaning: the period of gradual reduction of frequency and volume of breastmilk or formula which starts with the first introduction of complementary foods and gradually leads to dietary patterns customary in the infant's family during the second year of life.[17]

Key Questions

Key nutrition questions related to the **introduction of complementary foods** addressed in this NG are listed below.

Age of Introduction

- What is the recommended age to introduce complementary foods?
- What are the potential risks of introducing complementary foods earlier or later than recommended?
- When can fluids other than breastmilk or formula be introduced?

Types of Complementary Foods

- What is the recommended order for introducing complementary foods?
- What feeding approach is recommended when introducing complementary foods?
- What textures are recommended when introducing complementary foods?
- What are some considerations around the 'original' baby-led weaning approach?
- What are the recommendations for offering home-prepared or family foods and foods marketed for infants?

Quantity and frequency of complementary foods

- While feeding breastmilk or formula, what is the appropriate order, quantity, and frequency to offer complementary foods?

Food Safety

- What are some food safety considerations for infants?

Resources

- Are there any resources on complementary foods that health professionals can use with clients?

Answers to Key Questions

Age of Introduction

What is the recommended age to introduce complementary foods?

It is recommended to introduce complementary foods to term infants around six months of age while continuing to feed breastmilk.[17,24–26] Up to six months of age, exclusive breastfeeding (with vitamin D supplementation*[17,27,28] or mixed feeding methods of breastmilk and infant formula provides all an infant's nutrient needs.[17] Breastmilk is the normal and unequalled method for feeding infants and along with appropriate complementary feeding is recommended for up to 24 months or longer, as long as the lactating parent and the child desire.[24] The main milk source (breastmilk, infant formula or 3.25% milk) continues to be an important source of nutrition for infants and children, in addition to complementary foods.[24] For more information on infant formulas see the following health professional resources:

- Infant Formulas – Summary Sheet for a list of retail infant formulas in Canada
- Infant Formulas – Ingredients and Indications for recommendations on their use
- Safe Preparation & Handling of Infant Formula
- Post-discharge Preterm Formula (PDPF)

For preterm infants, it is recommended to introduce complementary foods between 4 to 6 months corrected age.[29,30] The necessary developmental milestones for feeding are reached around the same age (corrected) as term infants but can vary depending on the degree of prematurity and severity of illness experienced during the neonatal period.[17] This recommendation is based on available literature and expert opinion as evidence remains limited.

- AHS Nutrition Services recommends that all infants and children in Alberta be given supplemental vitamin D daily. For more information, please refer to the following NG: Vitamin D.

Rationale

For both term and preterm infants, the age recommended for complementary food introduction supports:

- The time when an infant's physiological maturation and developmental changes allow for the safe introduction and progression of complementary foods.[31,32]
- An infant's increasing nutritional and developmental requirements can no longer be met solely by breastmilk[26,27] or infant formula.

Physiological Maturation

Gastrointestinal and renal functions do not pose limitations for the timing of introducing complementary foods.[17] Although a preterm infant's digestive capability is immature at birth, it improves with enteral feeds, particularly breastmilk.[17,23] Therefore, it is not a limiting factor for introducing complementary foods at the recommended age.[30]

Developmental Changes

To safely transition from a liquid to a semi-solid diet, infants need to be supported by anatomical changes in the oral cavity, a reduction in the tongue-extrusion or protrusion reflex, and the emergence of early gross motor skills.[17,25,33] Following these changes, a typically developing infant will display certain signs of readiness for complementary foods to indicate good head and neck control with truncal strength and stability.[17] Readiness for complementary foods is demonstrated around six months of age with the following signs, where an infant will:

- Hold their head in midline when lying on their back[17]
- Control their head well when pulled to sitting[17]
- Sit in an upright position with little or no support[25]
- Open their mouth to accept offered foods[25]
- Bring their hands to the midline of their body[17]

Although there is no specified number of signs an infant should be demonstrating, it is reasonable to expect preterm infants to show most of the signs of readiness before the introduction of complementary foods.[17,29] It is important for parents to watch for these signs of readiness before introducing complementary foods to ensure that the necessary developmental skills are in place for an infant to safely manage texturally appropriate solid foods.[17]

If an infant is older than six months and is not demonstrating readiness as described, notify the infant's physician. A referral to an occupational therapist, speech-language pathologist, and/or physical therapist may be needed in these cases.

What are the potential risks of introducing complementary foods earlier or later than recommended?

Introduction of complementary foods earlier than 'around six months' of age for term infants has potential risks:

- Gastrointestinal and respiratory infections: infants exclusively breastfed until six months of age may be protected against gastrointestinal infections[26,28] and respiratory infections.[28]
- Sub-optimal development: decreased production and consumption of breastmilk may lead to undernutrition.[34] In addition, for infants exclusively breastfeeding, replacing one or two feedings with complementary food results in a lower intake of non-nutritional factors (immunological and neurological), which are important for optimal development.[35]

There is insufficient evidence to include the following concerns as a rationale against earlier introduction of complementary foods:

- Type 1 diabetes and celiac disease: There is no evidence of an association between introducing gluten less than six months of age compared with thereafter and the risk of developing type 1 diabetes or celiac disease.[17]
- Overweight and obesity: Some studies have found varying levels of an association with the risk of overweight/obesity in later childhood when introducing complementary foods earlier (less than four months).[36–41] Even though there is evidence that may support a risk for overweight/obesity with an earlier introduction (less than four months), existing systematic reviews that conflict with these associations prevent the inclusion of this risk as a rationale against earlier introduction.[17,37]

Delaying the introduction of complementary foods has potential risks, including:

- Food allergy risks. Refer to the following NG: Introduction of Complementary Foods: Commonly Allergenic Foods.
- Iron deficiency: The risk of iron deficiency and iron-deficiency anemia progressively increases the longer iron-rich complementary foods are delayed beyond six months.[25] Preterm infants are at high risk of depletion of iron stores within the first two months of life as well as iron deficiency later during the first year of life.[25] For more information, refer to the Types of Complementary Foods section of this NG.
- Other nutrient deficiencies: Around six months of age, an infant is dependent on complementary food sources of zinc to meet their requirements.[25,32] This is especially true for breastfed infants as there is a sharp decline in zinc content in breastmilk over the first several months postpartum.[25] As iron-rich food sources, such as red meat and fortified commercial infant cereals can also be sources of zinc, additional practice recommendations for zinc are not needed.[25]

- Growth: If complementary foods are not introduced around six months of age, or if they are given inappropriately, an infant's growth may falter.[26] Studies finding an association between the risk of overweight/obesity in later childhood and later than the recommended introduction of complementary foods (greater than six months)[40] are limited, with existing systematic reviews concluding that there is no evidence for this association.[17,37]
- Parent-reported feeding difficulties: There is suspicion regarding critical periods for introducing specific food textures.[42] An observational study revealed that introducing 'meals with lumps' to term infants after nine months was linked with heightened parental concern regarding perceived feeding difficulties.[43,44] However, a systematic review evaluating the association between feeding difficulties, timing of complementary food introduction (including specific textures), and feeding techniques (such as baby-led weaning) could not draw conclusive findings due to study heterogeneity and identified limitations.[45]

When can fluids other than breastmilk or formula be introduced?

Other fluids can be offered as complementary foods are introduced, as outlined below. Small amounts of water may be offered in an open cup to help support the development of mature drinking skills.[24] At first, infants will need help with an open cup from the parent.[24] Cup skills, with assistance, progressively improve between 7 and 8 months of age, and by 12 months of age, most infants can hold an open cup with both hands and take several swallows without choking.[25] By 18 months of age, most infants will have the skills to independently drink from an open cup, although they may still spill occasionally.[46] Aside from open cups, other types of cups are not included in the scope of this guideline.

These other fluids (including water) should not replace breastmilk or infant formula when first starting complementary foods.[24] Milk containing 3.25% fat and plant-based beverages may be used as ingredients mixed in other foods. For key recommendations related to each fluid, refer to Table 1.

Table 1. Fluid Recommendations for Infants and Young Children*

Fluid	Key Recommendations
Water	• Water can be offered when complementary foods are introduced at around six months of age. • Water should not replace the intake of breastmilk or infant formula during the first 12 months of life.
Milk	• Milk containing 3.25% fat may be introduced as a beverage to healthy term infants between 9 and 12 months of age and continued throughout the second year of life • Preterm infants have increased iron needs and are not recommended to be offered 3.25% milk as a beverage until they are 12 months corrected age.
Plant-based beverages	• Plant-based beverages (fortified or non-fortified) are not appropriate alternatives to breastmilk, infant formula or pasteurized 3.25% milk in the first 24 months of life as they are generally lower in fat and calories.
Other drinks	• Offer vegetables and fruit instead of juice. • Drinks sweetened with sugar or sugar substitutes are not recommended for infants and young children. • Drinks containing caffeine (including energy drinks) and herbal teas should not be offered to infants or young children.

* For more information on each fluid, review associated NG Healthy Infants and Young Children

Types of Complementary Foods

A diverse diet of nutrient-rich complementary foods is recommended from 6 to 23 months of age,[47] beginning with iron-rich[24,25,48] and commonly allergenic foods.[49] It is important to also include a variety of vegetables, fruits, protein foods (both animal and plant sources) and whole grain foods by seven to eight months in addition to breastmilk or infant formula.[25]

What is the recommended order for introducing complementary foods?

- Iron-rich foods are recommended as the first complementary foods to introduce.[24,25,48] Refer to Iron for Babies and Young Children (search for 'iron for babies') for a list of iron-containing foods. Offering a variety of food sources of iron daily is recommended.[50] It is prudent to offer infants an iron-containing food each time complementary foods are offered and ensure at least one of the iron-containing foods each day is iron-rich, particularly for infants receiving breastmilk. This practice is encouraged, especially from 6 to 24 months of age, to support the rapid period of growth and development infants and young children undergo at this time.[24]

A breastfed infant's iron stores will be depleted at about six months of age.[24,31,32] Exclusively breastfed infants that are at an even higher risk of iron depletion include those that: are born to mothers with a low iron status, have had early umbilical cord clamping (less than one minute after birth), or are born small-for-gestational age (SGA).[17] Even though these infants may benefit from the earlier introduction of iron-rich complementary foods (before six months of age),[17,31] iron stores are dependent on several factors and may be optimized by other methods (i.e. delayed cord clamping or iron supplementation).[31] Recommendations for infants at higher risk of iron depletion can be determined by individual assessment from their primary care provider.

For preterm infants, iron supplementation may continue to be necessary to meet their increased nutrient needs. Supplementation is typically started before hospital discharge and ongoing assessment is required to ensure the infant is meeting their requirements. In AHS practice, this supplementation should be continued until the infant is at least 12 months corrected age and is accepting a variety of iron-rich foods.[30] The infant's primary care provider or RD will guide as to when iron supplementation should be discontinued.

Other than iron-rich foods and commonly allergenic foods no evidence was found to suggest a benefit to offering other complementary foods in a specific sequence. Except for newly introduced commonly allergenic foods, many organizations consider it not necessary to wait any length of time between offering new complementary foods.[51] A delay between the introduction of new foods may lengthen the time it takes to incorporate a variety of foods and nutrients that are needed to support an infant's growth and development. Between 6 and 12 months is a time when the number of new foods accepted by infants is the most rapid.[52] Iron-rich foods can be offered alongside other complementary foods, including vegetables, fruits, whole grain foods and/or protein foods from Canada's food guide.[53]

What feeding approach is recommended when introducing complementary foods?

To promote and support the development of healthy eating skills, habits, and a healthy feeding relationship, a responsive feeding approach is recommended.[26,47] In this approach, parents respond to an infant's hunger and fullness cues to allow an infant to guide feedings.[24,47] When parents are sensitive to these cues, they can determine the level of support an infant requires, from feeding an infant directly to assisting them when they feed themselves.[24,54]

A responsive feeding approach allows parents to offer foods in a consistency appropriate for an infant's age and neuromuscular development as feedings will be 'infant-led'.[54] (Note the difference from 'baby-led weaning').

What textures are recommended when introducing complementary foods?

Developing universal timelines for recommended textures is difficult because of the significant differences among children in their rates of development, differences across cultures regarding when complementary foods are traditionally introduced, and the delicate balance between providing textures that are challenging but safe to swallow.[55]

Food Textures–Overall Guidance

- Offer foods using responsive feeding practices, encouraging an infant to progressively eat independently[47,56] and tailor food textures to an infant's developmental needs.[56]
- Once an infant is successfully managing a current texture, continue to gradually add more complex textures that need increasing chewing strength and stamina[57] (lumpy, diced;[58] larger and harder pieces[59,60]) to support feeding skill acquisition and texture acceptance.[58,61,62]

The following table is based on reported mean ages at which infants have been shown to successfully manage the indicated food textures. Individual infants may be able to manage these textures earlier or later than indicated.

Table 2. General Guidance for Food Textures

Typical Accepted Textures	Texture Description	Rationale
Six to eight months		
• Smooth, moderately thick puree[60,63–65]	• Moderately thick puree–food drips slowly through prongs of a fork; easily pours from a spoon[65]	• To support feeding skills needed to transition from liquid to solid foods (e.g., development of tongue control and oral transport of foods).[54,63] Useful for infants not able to feed themselves around six months.[66]
• Thicker puree	• Extremely thick–thick enough to form a mound on a fork	• To increase the likelihood of infant acceptance.[67 60]
• Mashed (e.g. mashed banana, soft cheese [brie])[59,63]	• 'Rough' puree	

Typical Accepted Textures	Texture Description	Rationale
Six to eight months (continued)		
• Minced and moist;[65] lumpy	• Thick puree with soft, small lumps.[64,68] Holds its shape on a spoon; lumps are easy to squash with the tongue; can be easily mashed with little pressure from a fork[65]	• Tongue moves lumps to gum rides which triggers reflexive up-down munching. Helps develop tongue lateralization skills and muscle stamina for chewing.[64]
• Dissolvable solids (also called transitional foods)	• A solid food that changes into another texture when moisture (e.g. water or saliva) is applied.[65] These foods are initially dry and crunchy but melt in the mouth. They require little chewing to soften before swallowing.[57] Examples are wafers, some crackers, commercial 'puffs'[65] and some cereals.[62]	• May help develop chewing actions[57,65]
• Soft, small pieces[59,63,65,68]	• Easily squished with a fork.[65] Can be compressed between tongue and palate.[59,60,69]	
Nine to eleven months Continue with previously accepted textures		
• Tender pieces (e.g. shredded chicken.[63,70]	• Tender: easily chewed; not tough.[71]	• Continue to increase the variety of foods and textures offered in a tender consistency.[70]
Twelve months to four years Continue with previously accepted textures		
• Variety of family foods with modified textures.[24] • Large firm pieces.[60] • Harder pieces[60,63]		• Require the tongue, teeth and masticatory movements to be swallowed[59] • The ability to manage more challenging textures (harder, crunchy, chewy)* continues to progress as young children acquire full chewing movements.[24]

*Examples of more challenging textures include raw hard vegetables, such as lettuce and pieces of cooked meat.[72]

Rationale and Considerations

Analogous to the process involved in the development of other motor skills such as walking (rolling to crawling to standing to walking) is the process of oral skill development in which infants acquire the necessary skills to be able to successfully manage different textures.[72] The development of eating skills is a gradual process, evolving as a result of both developmental changes and types of foods eaten.[73]

However, there is limited evidence as to which textures are accepted and most beneficial at a given age to foster acceptance of a variety of textures.[63,74] Available research shows the acquisition of eating skills is the most evident between 6 and 12 months of age[63,75] and continues to refine until four years of age.[73] However, within this time the ages at which infants achieve feeding skills to safely manage certain food textures varies widely.[63,68,76] Only a few textures have been directly tested with infants under nine months of age [59,60,63,74,75,77] and the earliest ages at which infants can manage textures other than pureed and mashed foods has not been well studied.[59,62]

Parents should provide age- and developmentally-appropriate foods to help prevent choking.[48] Choking, which is life-threatening, differs from gagging, which is a normal reflex[66] designed to eject items from the mouth that pose a choking risk.[64] infants experience gagging when food remains on the back of the tongue when they are not yet able to collect the food bolus and move it backwards with efficiency for swallowing.[78] As part of typical development, the gag reflex is de-sensitized and triggered more posteriorly.[64] The mean age that which infants are reported to eat food with tiny lumps without gagging is 8.7 months.[68]

While teeth do not need to be present for infants to successfully eat pureed and mashed food,[64] infants under the age of 12 months often will not have the teeth necessary to properly bite and chew harder textures of food.[79] Molars, which are necessary for basic chewing and grinding, typically start to erupt between 12 and 18 months of age.[79]

The age at which infants are expected to feed themselves with their fingers ranges from 4 months[17] to 9 months of age.[46] Infants between 5 and 6 months of age can bring foods to their mouths long before they have the oral control to chew lumps of these foods.[78] By nine months of age, infants can use their thumb to rake food into the palm of their hand (a radial-palmar grasp).[78]. Gradually this is refined into a pinching movement (an inferior pincer grasp),[78] and by 12 months of age, most infants can pick up small pieces of food between their thumb and index finger (pincer grasp) to feed themselves.[46]

What are some considerations around the original baby-led weaning approach?

The term 'baby-led weaning' was introduced by Gill Rapley, an author from the UK, to describe a feeding approach that does not include any spoon feeding by an adult, and instead relies on an infant to self-feed whole foods from the beginning of complementary feeding.[12,80] This approach is described as an infant directing and controlling the process of complementary feeding from the very beginning,[12] bypassing spoon feeding and pureed foods and moving directly to feeding themselves with their hands.[81]

Baby-led weaning is often presented as being a more responsive approach to an infant's hunger and fullness cues;[12,72,81,82] however, responsive feeding requires infant feeding can be responsive regardless of the level of assistance or texture provided. The original baby-led weaning concept will only align with responsive feeding if the infant can self-feed and successfully manage (chew and swallow) the food textures being offered. For infants who do not have these skills, the original baby-led weaning approach would not be consistent with responsive feeding or appropriate for all infants as parents would need to assist in feeding.[24,54]

Considerations for health professionals to help answer questions about baby-led weaning:

- To provide tailored advice, inquire how parents will/are practicing baby-led weaning. Many parents who self-identify as following baby-led weaning may actually offer some foods on a spoon.[83,84] Emphasize and encourage parents to practice responsive feeding (regardless of feeding approach) to allow the infant to guide feedings, whether or not pureed textures or spoons are used.
- Not all infants will be able to feed themselves[46] or have the oral skills to safely manage foods that require biting and chewing[72] (more complex) at the time complementary foods are needed. As feeding skills develop rapidly, encourage parents to watch for signs that the infant is developmentally ready for more complex textures, as these skills may be acquired soon after starting complementary foods.
- Emphasize the importance of including iron-rich foods in a texture an infant can safely manage to help meet their increasing nutritional and developmental requirements. Even though evidence in this area remains limited, some studies have found that infants fed using a baby-led weaning approach consumed less iron from 6 to 9 months compared to 'traditional spoon-fed' infants.[85,86]

Regardless of the approach taken, modify foods that may pose a choking risk by altering the texture.[17]

What are the recommendations for offering home-prepared or family foods and foods marketed for infants?

From six months of age, it is recommended to offer infants many of the same foods as the rest of the family.[24] Offering a variety of modified family foods allows for greater exposure to traditional and cultural foods, while also allowing for variations in texture and flavour.[31]

Infants have an innate preference for sugar and salty tastes.[31] Timely introduction of a variety of complementary foods without added sugars and salt will help to expose an infant to a food's natural flavours,[24] including bitter tastes.[31] This may help with an infant's acceptance of different flavours over time.[31] Some considerations for preparing and serving family foods that may help support acceptance of different flavours include:

- Adding little to no sugar or salt to the infant's portion.[24]
- If offered, fruit purees should only be part of a meal and not replace entire meals.[87]
- Offering a wide variety of flavours, including bitter-tasting vegetables.[31]

Store-bought foods marketed for infants can also be an appropriate choice.[88] Some considerations for offering these foods include:

- **Feeding skills**: Squeezable pouches are a convenient and readily available choice for some parents.[87,89] If using squeezable pouches, the food should be removed from the pouch and fed with a spoon whenever possible. Sucking the food directly from the pouch may hinder the development of spoon or finger-feeding skills.[87]
- **Texture:** Foods marketed for infants may not provide an adequate variety of textures.[89] In particular, squeezable food pouches predominantly have a smooth pureed texture.[90] Expanding food consistencies offered over the complementary feeding period will support feeding skill acquisition.[24] Prolonged and predominant use of pureed infant foods is not recommended.[31]
- **Sugar content:** Foods marketed for infants may be high in sugar, both from added sugar[24] and the use of sweet fruits, fruit juice concentrates, and concentrated fruit preparations.[87] Consuming too many added sugars has been linked to an increased risk of tooth decay in children and excess calorie consumption.[91] When purchasing these foods, parents can be encouraged to review the ingredients list to choose options with no added sugar. Fruit juice concentrates are considered added sugars.[92] Other food products list added sugars in brackets after the word 'sugars' in the ingredient list.[93]

- **Flavour:** Foods marketed for infants tend to include a limited variety of vegetables, often including sweet-tasting vegetables (e.g., sweet potato or carrot) instead of those that are more bitter-tasting (e.g., green vegetables).[31] When there is a combination of fruit and vegetables, the flavour profiles of the vegetables are often masked by the first ingredient, which is usually fruit.[94] Although it is unclear if intake of sweet-tasting foods will impact food preferences later in life[95] for infants to accept a variety of vegetables, repeated exposure to the unmasked flavour of the vegetable is important.[94] Higher intakes of foods marketed for infants may be associated with decreased vegetable intake in infancy.[96]

Quantity and Frequency of Complementary Foods

While breastfeeding or formula feeding, what is the appropriate order, quantity, and frequency to offer complementary foods?

From 6 to 12 months of age, infants can meet their nutrition needs with a combination of breastmilk (and/or infant formula) and complementary foods.[27] Consistent with the World Health Organization's guiding principles for complementary feeding, Health Canada recommends that breastfeeding be sustained for up to two years of age or longer, alongside the introduction of complementary foods.[27,47] Recent evidence shows breastmilk contributes on average approximately 80% of an infant's total daily energy requirement from 6 to 8 months of age, approximately 65% from 9 to 11 months of age, and approximately 45% from 12 to 23 months of age.[97] However, because the quantities of complementary foods vary by factors such as age, activity level, metabolism, and local contexts,[47] and should be guided by an infant's hunger and fullness cues,[98] specific amounts are not provided here.

Complementary foods can be offered with breastmilk/formula feedings, or in between.[99] There is no scientific evidence stating whether breastmilk/formula or a complementary food should be offered first at a feeding.[54] Parents are encouraged to respond to their infant's cues. For example, if the infant is content and interested in trying a new food, offer it first and offer breastmilk or formula second. On the other hand, if the infant is not used to complementary foods, is upset or very hungry, offer breastmilk or formula first. This may calm the infant and increase interest in trying a new food.

The number of times per day that complementary foods are needed to meet energy and nutrient requirements varies depending on the amount of breastmilk and/or formula an infant is drinking and the energy density of complementary foods.[100] For example, based on the mean energy density of foods among US infants 6 to 11 months[101], and average breastmilk intake,[100] the number of complementary foods meals needed is one to two per day from 6 to 11 months.[100] To start, parents are encouraged to offer complementary foods once a day in small amounts around six months, and to increase the amount and frequency that complementary foods are offered as they grow older, in accordance with their hunger and fullness cues*.[54]

General guidance on the number of complementary food feedings is two to three times per day for infants 6 to 8 months of age and three to four times per day for infants 9 to 23 months of age, with one to two additional nutritious snacks for ages 12 to 23 months, based on a child's signs of hunger and fullness.[102] This is in addition to on-demand breastmilk feeding.[26] At about 12 months, parents can begin to establish a schedule of regular meals and snacks.[98] Parents can be reassured that the amount of complementary foods that an infant consumes at a given feeding will vary, due to differences in breastmilk and/or formula intake, variability in growth rate, and appetite.* As infants consume a greater proportion of total energy (kcal) from complementary foods, their intake of breastmilk may gradually decrease.[48]

*For more information on appetite (e.g. hunger and fullness), see the Healthy Feeding Relationship NG.

Food Safety

What are some food safety considerations for infants?

Table 3. Food Safety Considerations for Introduction of Complementary Foods

Topic	Recommendations to provide to parents
Safe food handling	Children five years of age and under are at an increased risk for food poisoning and related health complications.[91] • For information on safe food handling and higher-risk foods to avoid, refer to Health Canada resource: Safe Food Handling for Children 5 and Under. • For information on hunting and safe handling of wild game, refer to Health Canada resource: Food safety for hunting. • For information on other food safety topics such as home canning, refer to Health Canada: General food safety tips
Honey	• Do not give any type of honey to infants under 12 months of age due to the risk of infant botulism.[70,103] The risk is present even with honey that is pasteurized or cooked/baked in products as the temperatures used in pasteurization and cooking/baking are not sufficient to destroy the *Clostridium botulinum* spores.[70] • Honey can be given to children 12 months of age or older. By this age, children have developed bacteria to protect against Clostridium botulinum spores.[103]

Topic	Recommendations to provide to parents
Mercury	The types of fish that are most popular in Canada are relatively low in mercury[104] and have no recommended consumption limits.[105] If offering canned tuna, offer 'light' (skipjack, yellowfin and tongol) canned tuna as these are lower in mercury. Certain predatory fish tend to contain higher levels of mercury.[105] If offering these fish to infants and young children, follow Health Canada's consumption advice: • canned albacore ("white") tuna (does not include canned "light" tuna) o Six to eleven months of age: less than 40 g (approximately ¼ cup) per **week**[105] o One to four years of age: up to 75 g (approximately ½ cup) per **week**[105] **or** • fresh or frozen tuna, shark, swordfish, marlin, orange roughy or escolar o Six to eleven months of age: less than 40 g per (approximately ¼ cup per **month**)[105] o One to four years of age: up to 75 g (approximately ½ cup) per **month**[105] For advisories regarding fish caught in local lakes and rivers, refer to My Wild Alberta.
Arsenic	Rice and rice-based products have been found to contain high concentrations of arsenic relative to other foods.[106] • Although infant rice cereal has previously been used as a common first food and can still be included, it is recommended that it not be the only grain in an infant's diet.[48] • Include a variety of infant cereals/grains,[107] such as oats, barley, wheat, quinoa, buckwheat, amaranth, and chia. For more information on arsenic, please refer to the NG: Arsenic in Foods.
Choking	• Parents should be aware of their infant's chewing and swallowing abilities and provide supervision during eating.[24] • Parents can promote safe eating by offering foods when the child is sitting upright and not distracted from the task of eating.[24] • Foods that are hard, small and round, or sticky and smooth are more likely to cause choking and should be avoided in children under the age of four years.[99] • Modify foods to make them safer for young children, such as spreading peanut butter thinly on toast[24] or cutting grapes into smaller pieces.[99] • Parents are encouraged to obtain appropriate first-aid training, as not all choking incidents are preventable.[24]
Sugar substitutes	• Sugar substitutes are not recommended for infants under 12 months of age and generally should not be offered to children.[24] • For more information, please refer to the NG: Sugar Substitutes

Resources

Are there any resources that health professionals can use with clients?

For client resources on introducing complementary foods, visit Nutrition Education Materials at: ahs.ca/NutritionHandouts and search 'solid foods'.

For more information related to healthy infants and children, visit HealthyParentsHealthyChildren.ca

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