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<th>Description</th>
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<td><strong>Slide 1</strong></td>
<td>Welcome to the module Introduction to Solid Foods. In this module, we will be discussing the introduction of solid foods for infants. We will also provide an overview of feeding issues of children 12-60 months of age.</td>
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<td><strong>Slide 2</strong></td>
<td>We will begin by describing the feeding skills development and the signs of readiness for solid food introduction.</td>
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<td><strong>Slide 3</strong></td>
<td>Infants are not ready to consume solid foods at birth. The gastrointestinal tract and renal systems of infants are not fully mature and are not capable of tolerating anything besides human milk or infant formula during early infancy. Human milk and infant formula are capable of providing full nutrition in the first 4-6 months of life. As nutrient needs increase due to physiological growth and increased mobility, infants must begin to consume solid foods to provide adequate nutrients to support growth and development. Oral motor and gross motor development should guide the timing and progression of the introduction of solid foods; chronological age is not a good indicator of ability to handle solid food textures, particularly for children with developmental delays.</td>
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An overview of oral motor development is listed on this slide. In early infancy, several basic reflexes are in place which assist with suckling, such as the suck/swallow/breathe reflex seen during lactation. Infants have a rooting reflex which guides them in searching for a nipple based on the sensation of touch on their cheek or lip. Rubbing your finger on a baby’s cheek will often stimulate them to open their mouth in anticipation of a nipple. Young infants have a strong tongue thrust reflex, which aids in nursing but makes feeding solid foods difficult. This reflex begins to reduce by 3-5 months of age allowing food placed in the mouth to stay in the mouth during feeding. The first few attempts at feeding solid foods are often frustrating for parents as tongue thrust still occurs. With repeated exposure to the sensation of a spoon or food on the tongue, the tongue thrust reflex will be reduced.

For some infants, such as those with Downs Syndrome, tongue thrust continues to be an issue well into later childhood. At 4-6 months infants begin to develop rudimentary chewing skills that resemble munching. The motion is only up and down rather than full rotary chewing so the texture of foods that can be managed is limited. By this time, most infants can transfer food to the back of the mouth and hold the bolus for swallowing. They often anticipate feeding, opening their mouths for a spoon. By 5-9 months of age many infants can begin early self feeding skills. They are able to pick up foods, such as cereal, bits of fruit and crackers and can guide them to their mouth. Chewing continues to develop and textures can be progressed. At 8-11 months, infants begin to be able to form lip closure around a cup rim and are able to begin to drink from a cup. Rotary chewing begins to occur and infants are capable of eating most textures of food. By 10-12 months, infants may be able to feed themselves with a spoon and cup. Most textures of foods are tolerated by children at this age.
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<th>Slide 5</th>
<th>Gross motor development should also guide the introduction of solid foods in infants. The use of gross motor development rather than chronological age is crucial in all infants, but especially so in those who were born preterm or low birth weight, who have any chromosomal or other disorders or are slow to develop. In order to safely consume solids, an infant must have good head control and trunk stability so that they can sit in an upright position during feeding. Introduction of solid foods before a child is developmentally ready can lead to choking, and repeated episodes of choking can lead to the aversion of solid foods and behavioral feeding issues. Additional gross motor skills such as reaching for and grasping objects are crucial later in infancy for self-feeding.</th>
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<td>Slide 6</td>
<td>Difficulty with feeding occurs in approximately 25% of infants. This usually is due to the infant rejecting foods of different textures, colors, taste and/or appearance. Infants who are not introduced to lumpy textured foods until they are over 10 months of age had more feeding difficulty at 15 months of age; the least issues were seen in children exposed to lumpy textured foods between 6 and 9 months of age. A ‘window of opportunity’ for introducing food textures appears to be critical for acceptability of foods by the infant. Emmet and Nethersole 2001</td>
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<td>Slide 7</td>
<td>presented earlier. These include infants who are born preterm, those who have significant health issues, and infants who do not receive adequate</td>
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Infants signal hunger in a variety of ways. The first signs are usually sucking on their own or their caregivers fingers or fists or moving their lips in a suckling manner. Crying may also signal hunger. If infants are older and more developmentally advanced, they may show excitement when a cup, spoon or bottle are presented. They will grab for the cup or spoon after 6-9 months of age. Young, inexperienced or anxious parents may have a tendency to feed babies whenever they cry, as a method of consoling them. While crying is often a sign of hunger, it may also be a sign of the need for stimulation or of frustration. Colic occurs in about 1 in every 4 infants. It is usually characterized by the “rule of 3’s” – it begins around 3 months of age, continues for 3 weeks or longer and consists of crying spells that last for 3 hours or longer.

Parents may try to console the infant through constant feeding. Parents should be instructed on ways to determine hunger from other reasons for crying, especially when reported food intake is high, weight gain is accelerated or colic is suspected. Almost all infants are born with a very well defined sense of hunger and satiety. They will eat when hungry and stop when full. In some cases physiological issues, such as gastroesophageal reflux, may induce pain when feeding, resulting in infants who appear hungry but refuse to eat. Infants with special health needs, such as those with Praeder-Willi syndrome, may also have difficulty with food regulation. Introductory foods should be offered by spoon in quantities of about 1 Tb. Early on, the goal is not a large intake of solid foods, but rather the goal is to stimulate oral motor development and to provide small amounts of nutrients not found in adequate amounts in breastmilk or formula, such as iron.

The signs of satiety among infants varies by developmental age. Very young infants will cease feeding when they are full and often fall asleep. Older infants may push a bottle, cup or spoon away when they are full. Parents should be encouraged to avoid force feeding young infants when they appear satiated in order to preserve the infant’s ability to follow satiety cues.

Overfeeding can occur if parents are not sensitive to satiety cues. Overfeeding can also occur if parents consistently respond to crying by feeding infant. Doing this may cause an infant to learn to rely on eating as a way of satisfying a variety of needs. Do NOT force baby to finish food or formula! Instead, offer appropriate amount at each feeding. Pacing bottle feeds (providing a feeding over a extended period of time) decreases amount taken in.
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<th>Slide 11</th>
<th>Next this module will describe introduction to solids and the progression of solids and textures.</th>
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<td>Slide 12</td>
<td>At 4 to 6 months of age, when first food is introduced, infants can be fed in a baby seat or high chair. Infants should be positioned at a minimum of a 45 degree angle with the head well supported to reduce the chance of choking.</td>
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<td>Slide 13</td>
<td>Infants with good trunk stability and head control can be fed in a high chair. Infants should sit upright with their feet properly supported to help them stay in position. Infant who slide out of the high chair or tip sideways may not have adequate muscle control for feeding in a high chair. Caregivers should be at eye level with infants when offering solid foods in order to observe infant feeding and to provide optimal stimulation.</td>
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<td>Slide 14</td>
<td>The introduction of foods should be done one at a time, with only one food introduced each 2-3 days. This waiting period allows the infant to adjust to the new taste and texture and also allows caregivers adequate time to determine if the food is a potential allergen. Mixed foods should not be introduced if the main ingredients have not been introduced separately before.</td>
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<td>Slide 15</td>
<td>The progression of textures in the diet follows oral motor development. Tongue thrust results in most solid foods being pushed from the mouth prior to 4 months of age. Generally at 6 months of age, pureed and strained foods can be started. Parents should be warned to look for signs of choking and to stop solid feedings immediately if this occurs. Parents should reassess gross motor and oral motor skills and consult with their pediatric care provider if choking continues despite apparently adequate development. Mashed foods are usually appropriate at 6-8 months of age and offered 2-3 times per day. Thick foods, such as mashed potatoes are often better tolerated than thinly mashed foods as the food bolus is easier for the infant to control. Ground meats and finely chopped foods can be introduced around 8-10 months of age. During this time, solids are offered 3-4 times per day. At 10-12 months of age, most infants can eat a variety of chopped table foods. It is important for parents to monitor oral motor development when feeding their infant new foods, rather than simply basing food changes on infant age.</td>
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The actual progression of specific foods is less important than the texture and developmental appropriateness of the food. Infant rice cereal is generally the first food that is introduced into the diets of US children as it provides the proper texture, is fortified with iron and is the least likely grain to cause food allergies. Some mothers are encouraged by family and friends to add infant cereal to the bottle as young as 6-8 weeks of age in order to “satisfy the infant’s appetite” or to “help the baby sleep through the night”. They often make the holes in the bottle nipples larger to allow the thickened liquid to be fed. This practice is NOT recommended as it can lead to excessive caloric intake, inadequate fluid intake and may be linked to accelerated weight gain in infants. In specific instances, such as gastroesophageal reflux, pediatric care providers may recommend thickened liquids, but this is not recommended for general practice among infants.

The next solids in the progression typically are pureed cooked fruits and vegetables. Some parents prefer to add vegetables first, followed by fruits, as they believe that this will increase the acceptability of vegetables among infants. There is no data to show that the order of adding fruits and vegetables affects long-term food preferences of infants. Complementary foods rich in iron and zinc should be introduced to the breastfed infant beginning around 6 months of age. Pureed meats are an excellent source of iron and zinc at this age. Usually the next foods added are soft, mashed foods like mashed cooked vegetables and potatoes, soft fruits, cooked eggs and pureed legumes. There is a great deal of debate in the pediatric nutrition circles right now about the “correct” progression of solids foods. The reality of the situation is that the most important factor is that the texture of the food be appropriate for the infant’s developmental stage. At 8-10 months of age, the texture of foods fed to infants can be increased. They can munch on crackers, cheerios, rice, chopped noodles, small chunks of banana and other soft fruits. Ground meats, moistened with water or broth, can be fed. At one year, most infants will be able to eat the same table food as the rest of the family, with foods cut into appropriate sizes.
### Slide 17
Infants should not be fed honey before 12-16 months of age due to the risk of botulism poisoning. At this age, the infant’s gastrointestinal defenses against bacteria are still maturing. The AAP recommends that fruit juice not be introduced before 6 months of age, and in fact, there is no nutritional benefit to offering juice at 6 to 12 months. Parents should be encouraged to use whole fruits in place of juice. It is important as textures of solid foods are progressed that appropriate sized pieces of food be fed. Anything larger than a nickel in size is a potential choking hazard. Hot dogs, grapes, round candies should be halved or quartered before feeding to avoid choking. Foods that have hulls, such as popcorn or seeds, should be avoided until 16 months or later when rotary chewing is established.

### Slide 18
This next section will provide an overview of feeding issues of children 12-60 months of age.

### Slide 19
Young children have small stomachs so they need to eat every few hours. A daily meal pattern that consists of 3 meals and 3 snacks per day will meet the needs of most children. Children who eat less than 2 snacks per day or more than 3 snacks per day tend to consume diets that are not as nutritious as those consuming the pattern listed above. Snacks currently provide about \(\frac{1}{4}\) to \(\frac{1}{3}\) of the energy consumed by young children. Therefore, it’s important that parents and caregivers view snacks as “mini meals” and not as a time to consume sweets, chips, salty snacks and soft drinks. Around one year of age growth begins to slow and appetite decreases in corresponding fashion. Children also become more engaged in the world around them and are more easily distracted at mealtimes. Parents should be encouraged to feed children at the table without TV or other distractions in order to keep the focus on eating.

### Slide 20
Nutrients that are most likely to be deficient in the diets of young children are the minerals iron, calcium and zinc, as well as the vitamins B-6, C, E and folate. This reflects the poor intake of non-processed meat, meat substitutes, fruits and vegetables among youth. The nutrients most likely to be consumed in excess of needs include fat, added sugars (especially high fructose corn syrup) and sodium. These nutrients reflect the high intake of processed meats, sweetened cereals, chips, snack crackers, soft drinks and refined grain products by most children.
Parents tend to overestimate the amount of food that children need and underestimate amount of food that children consume. This is known as “portion distortion”. Many parents falsely assume that children should have “half of adult size serving”. In fact, the rule of thumb is 1-2 Tbsp per year of age until 4-5 years old, which is equal to 1/4 cup of spaghetti for 3-4 years old. Adults see 3 cups as typical adult portion and therefore think their children need 1-1/2 cups of spaghetti.

Portion sizes for infants and child are SMALL. The rule of thumb is 1 to 2 tablespoons of each food per year of age. Parents need to be reassured that children’s stomachs are small and portion sizes should be as well. They also should be reminded that children have an innate ability to regulate food intake based on energy needs and activity level so parents should respect this. Children are good regulators of food intake and should be allowed to eat what is served and then ask for more if they are still hungry. Serving large portion sizes can lead to over consumption. Portion sizes of foods appropriate for toddlers and preschool-aged children are listed here.

For most families, the evening meal is the meal that parents struggle with most. Parents may be tired from working all day and have a difficult time meeting the attention demands of children while preparing a meal. Children who are no longer napping may become tired and irritable, leading parents to feed them a snack before mealtimes in order to keep them quiet. All of these factors should be addressed with families and caregivers of children who express concern over a child’s eating habits. Rituals can be very important for all young children. Children may go through phases where they prefer to eat only one type of food (bread or tuna) or where they will only eat foods out of specific dishes or with specific utensils. Some children will eat only certain colors of food (yellow/orange cheese is ok, white cheese is not) or will eat sandwiches cut in triangles but not in squares. While these issues may drive parents crazy, they are usually harmless ways for children to gain some control over their environment at mealtimes and are developmentally appropriate. If the food issues become a problem to the point where the food intake of the child is severely limited or compromises nutritional status, parents and caregivers should be referred to their pediatric care provider for further consultation and assessment.
Toddlers and preschool-aged children are notorious for their changing food habits or “picky” eating. The texture of food is one of the major factors that affect the acceptability of foods by young children. This is largely because the mouth is one of the main ways by which children sense things in their surroundings. You will often see children pick something up and put it in their mouth – it’s an early form of identifying and exploring objects for young children. The mouth’s of children are very sensitive for this reason, making them more reactive to textures, tastes and temperatures than adults. Foods that are stringy in texture, such as meat, chicken or fish, may not be well accepted by children at first. This texture is foreign to them and their experience with the texture must be increased before they will accept these foods readily. Research has shown that repeated exposure to foods, 12-20 times per food, is needed before children actually determine a like or dislike for a food. Mixing meats with familiar textures, such as pasta or soft vegetables, may increase the acceptance of the texture. Thin liquids may be harder for very young children to handle. Some older children with poor oral motor control may also have difficulties with thin liquids. Thickening foods such as soup with instant mashed potatoes can assist children in swallowing these foods at younger ages. The thickening can gradually be reduced as the child ages and becomes better able to handle thin liquids.

Children are born with a preference for sweets and a distaste for bitter flavors. Fruits and juices may be more acceptable with less exposure than vegetables and meats. However, it’s important for parents to offer children repeated exposures to a wide variety of foods to increase their acceptability of foods. Excessive juice intake is a problem for many children. Some research has linked excessive juice intake to increased risk of overweight or reduced stature, but results are not entirely consistent across studies. A high intake of juice may displace the intake of more nutritious foods and beverages and should be avoided. In high amounts, juice can also lead to flatulence, stomach distention and diarrhea. Parents and caregivers should be reminded to limit juice intake to 4 ounces per day or less for children. Salt is another taste that children naturally gravitate toward. Traditional foods contain more than enough minerals to meet daily needs and additional salt is not needed. Bitter foods are often least tolerated by young children. Many vegetables will be tolerated later in life but not in early life due to bitter flavors.
Parents frequently complain of struggles with their young children over eating. Many parents think that a child’s refusal to eat or their need to have rituals is the child acting out toward the parent or an attempt by the child to “get their way”. In reality, young children are in a key developmental stage where they are exploring autonomy and trying to develop their own sense of themselves separate from their parents. Part of this exploration includes learning how to negotiate their wants and needs, including those of food. Three areas of daily life that children learn they have control of, but parents do not, is eating, toileting and sleeping, so these three areas are common areas of negotiation and concern among parents. When parents express concern over their child’s eating issues, they should be reassured that this is a normal developmental stage. Parents should be encouraged to set some limits to mealtime behaviors and the foods that are served, while also allowing for some flexibility. Parents must also be assured that the child is not trying to control or manipulate parents and that parents should not take the behavior as a sign of poor parenting. We will discuss this more in the next few slides.

The food issues of concern that are often reported by parents include food jags, refusal to eat and refusal to follow mealtime rules. Food jags occur when children only want to eat certain foods continuously or will eat a food one week but not another. Children may also refuse parental attempts at controlling food intake, such as type and quantity of food offered, through refusing to eat, gagging on food or gorging on food. Children often test mealtime rules and behavior limits as well. These behaviors are part of children learning to become independent from parents but at the same time wanting some consistency in meals, which makes them feel comfortable. For parents, setting clear rules and CONSISTENTLY enforcing these rules is the key to managing food-related issues at mealtimes.
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<th>Slide 28</th>
<th>Clara Davis described the basic division of responsibility between children and adults over mealtime behaviors in the 1920s. Ellen Satter popularized this theory in the past few decades. Parents are responsible for certain activities around eating and meals. Parents should purchase healthy foods and beverages and make these items readily available in the home. Parents are responsible for preparing and serving healthy meals and snacks in appropriate amounts at appropriate times, making sure that the child sits with the family at the table at each mealtime, even if the child decides not to eat, limiting distractions, such as having the television on during mealtimes, and modeling appropriate eating behaviors. It is crucial that caregivers and parents realize how influential their behaviors can be on children around them. They need to understand that children are not likely to eat vegetables if the adults around them do not eat vegetables and that children will want to drink soft drinks if that's what they see adults drink. It's also crucial that caregivers not force children to eat. Children can be required to attend meals even if they choose not to eat and should not be punished by withholding food.</th>
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<td>Slide 29</td>
<td>The child’s responsibilities are: to choose how much and what to eat, to wait until the next meal or snack to have something to eat if they choose not to eat what has been served to them, to attend all meals even if they choose not to eat, to taste at least 1 bite of each food served and to follow family rules for table manners. Parents should be encouraged to serve at least one food or beverage item that they know children will eat at each meal to assure some intake of foods. Having bread or milk available at each meal ensures that the child will likely consume something at the meal even if they choose not to eat the main dish or vegetable served. There is a great deal of controversy over whether or not to hold dessert until the main meal has been consumed. In general, withholding dessert until the child has taken at least one bite of each food is acceptable. Desserts should be healthy foods such as fruit, pudding or cereal bars that can easily be incorporated into a healthy diet and are less likely than sweets to be seen as a special food.</td>
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Children must understand what is expected of them at mealtimes. Mealtime rules should be developmentally appropriate and clearly understood by the child. With older, verbal children, some mealtime rules can be negotiated, which allows the child to feel part of the process. Parents should remain calm when children do not follow rules and should remind the child of the appropriate expected behavior. Reinforcement of the rules is as important as the type of rules that are set. Positive behavior should be rewarded as much as possible and bad behavior should be ignored.

Besides poor eating behaviors, parents may have to contend with other feeding concerns such as over- and under nutrition, both of which are issues for millions of young children. While over nutrition and excessive calories are major problems for many US children, under nutrition continues to be a problem for some. Over 25% of children under 6 years of age live in poverty and over 50% of single parent households live in poverty. Low-income children are at especially high risk for inadequate intakes of calories, iron, calcium, vitamin C, vitamin A, zinc and protein and are at increased risk of overweight and short stature. Anemia and lead poisoning also disproportionately affect low-income children. Iron deficiency anemia is more than twice as prevalent in low income children than in higher income children and can lead to decreased motor and mental development. Lead poisoning can lead to an increased risk of developmental delays, anemia, decreased linear growth and obesity. The risk of lead poisoning appears to be increased by poor intakes of calories and certain nutrients, including calcium, phosphorous, iron and zinc. Iron deficiency and lead poisoning are often co-morbid conditions in young children from poor backgrounds.
### Slide 32
Food insecurity, or the lack of access to adequate and safe foods, is a growing issue in the US. Almost 1 in 6 households with children is food insecure in the US and about 4% experience hunger, which means that household members go without food due to food insecurity. This translates into 13.9 million children living in food insecure homes and 3.3 million children living in homes that experience hunger. Of homes with food insecurity, 47% of those have incomes greater than 130% of the federal poverty line. Children from food insecure homes are more likely to have poor health status and anemia. Women and children who are food insecure have been found to be at increased risk of overweight. The exact cause for this relationship is not known. It is important to note that many of the same factors contribute to both food insecurity and obesity: being from a racial or ethnic minority, being of low socioeconomic status and having low educational attainment among parents.

### Slide 33
We will conclude with discussing physical activity recommendations.

### Slide 34
Physical activity is an important aspect of child development. Parents and caregivers should be encouraged to model physical activity whenever possible and should also be sure to allow children ample opportunities to learn to do daily tasks themselves.

### Slide 35
The age range during which specific motor skills are developed is listed here. These data come from Bright Futures in Practice: Physical Activity which is an excellent online resource for health professionals.

### Slide 36
Examples of age-appropriate activities are listed here.

### Slide 37
Now it is time to test your knowledge

#### Slide 38
Question 1: Which of the following are hunger cues? A. Small sounds B. Fussing or crying C. Sucking on fingers D. Smacking lips E. a and c F. All of the above

Answer: F. All of these are hunger cues

#### Slide 39
Question 2: The progression of specific foods is less important than the texture and developmental appropriateness of the food. A. True B. False

Answer: A. True
| Slide 40 | Question 3: What is the general rule for each food group for child portion sizes? A. 1 teaspoon per year of age B. 1-2 tablespoons per year of age C. ¼ cup per item D. None of the above  

Answer: B. |
| --- | --- |
| Slide 41 | Question 4: Which of these is not a parent’s responsibility for feeding their child? A. Choose how much the child eats B. Modeling C. Choose the food served D. Limit distractions  

Answer: A. The child's responsibility is to choose how much to eat. |
| Slide 42 | Question 5: Which of these are a responsibility of the child when eating? A. Wait until next snack/meal if hungry B. Taste all food served C. Attend all meal times D. Decide whether to eat or not E. All of the above F. None of the above  

Answer: E. All of these are child responsibilities during meal time. |
| Slide 43 | Quiz Result |
| Slide 45 | This completes the module Introduction to Solid Foods, presented by the Minnesota Department of Health WIC Program |