Early Feeding: Setting the Stage for Healthy Eating Habits

Julie A. Mennella and Alison K. Ventura

Food habits are an integral part of all cultures, and these habits have their beginnings during gestation and infancy. This chapter outlines the biological underpinnings that drive food choices and reviews how the inherent plasticity of these senses interacts with early-life experiences during breastfeeding, formula feeding, and weaning.

The senses underlying flavor perception (taste and smell) develop and function in utero. By the third trimester, the fetus can detect the tastants and retronasally perceive the odors from the mother’s diet through the amniotic fluid. Fetal swallowing frequency increases in response to the introduction of sweet solutions into the amniotic fluid and decreases in response to the introduction of bitter solutions, which may be one of the first indications that our basic biology favors consumption of sweet tastes and avoidance of bitter tastes. Similar preferences for sweet and distaste for intensely bitter and sour tastes are apparent shortly after birth, and heightened preferences for sweet and salty tastes are evident throughout childhood and adolescence. These innate responses to taste during childhood are likely an evolutionarily adaptive trait. That is, they likely evolved to encourage us to detect and reject that which is harmful (e.g. toxins, signaled by bitter taste, unripe fruits signaled by sour tastes) and to seek out and ingest that which is beneficial (e.g. energy-dense foods, signaled by sweet taste, and needed minerals, signaled by salt taste).

While there are innate responses to tastes, our biology is not necessarily our destiny. Early childhood is characterized by a high degree of plasticity, as young children are predisposed to learn about their sensory world through repeated exposure and through social modeling. Amniotic fluid is the first medium for flavor learning, as offspring come to prefer the tastes and odors they experienced in utero that are transmitted from the mother’s diet. This flavor learning continues when infants experience the flavors of the mother’s diet transmitted through breast milk. Breastfeeding confers an advantage when infants
Table 1. Steps parents can take to promote healthy eating habits in children

<table>
<thead>
<tr>
<th>Developmental stage</th>
<th>Intervention</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prenatal</td>
<td>1. Eat a wide array of healthy foods during pregnancy. Flavors in the mother's diet are transmitted to amniotic fluid and influence later flavor preferences; every fetus has a unique flavor experience depending on the mother's diet.</td>
<td>[1–3]</td>
</tr>
<tr>
<td>Neonatal Breastfeeding</td>
<td>2. Eat a wide array of healthy foods during lactation. The flavor of human milk reflects the diet of the mother; every breastfed baby has a unique flavor experience depending on the mother’s diet. Prepare the baby’s cereal with mothers’ milk to provide familiar and preferred flavors. Offer the baby the foods the mother ate during pregnancy and lactation to provide a continuity of flavor experience (see steps 4 and 5).</td>
<td>[1, 4, 5]</td>
</tr>
<tr>
<td>Formula feeding</td>
<td>3. Be aware that infant formula provides a monotone flavor experience for infants. While infants learn to prefer the flavors of their formula, they may have a more difficult time initially accepting fruits and vegetables since they have not had the same varied flavor experience as breastfed infants. However, formula-fed infants can learn to accept initially rejected foods (see steps 4–6).</td>
<td>[6–8]</td>
</tr>
<tr>
<td>Weaning</td>
<td>4. Offer new foods multiple times. The baby's initial rejection of a new food may not be an indication of dislike, and it may take longer to observe changes in facial expressions than in intake. Infants’ acceptance of novel foods increases after 8–10 exposures to a food (meaning tasting, not just seeing the food).</td>
<td>[4, 7, 9, 10]</td>
</tr>
<tr>
<td></td>
<td>5. Introduce a wide variety of healthy foods. Opportunities to taste a variety of foods promote infants’ willingness to try new foods. Infants who were fed a variety of fruits were more accepting of novel fruit and those fed a variety of vegetables were more accepting of a novel vegetable.</td>
<td>[9, 10]</td>
</tr>
<tr>
<td>Toddlerhood/preschool years</td>
<td>6. Be a good role model. Children are more likely to eat a new food if their parents are eating the same type of food compared to when parents are merely present or are eating a different food. Thus, the combination of repeated exposures to a variety of novel foods and social modeling of intake of those foods can help promote children’s acceptance and liking of that food.</td>
<td>[11–14]</td>
</tr>
</tbody>
</table>
are weaned to solid foods since they will eat more of the fruits, vegetables, and spices that were experienced in breast milk, which teaches the infant about the foods that are available to and consumed by the culture and, more specifically, by the mother. In striking contrast to the varied and rich sensory experiences of the breastfed infants, early flavor experience of formula-fed infants is more monotone and lacking in the volatiles of the foods of the mother’s diet. Nevertheless, infants learn to prefer the flavors of the formula they are fed. At weaning, regardless of feeding mode, infants learn through repeated exposure to a particular food as well as through exposure to variety. We also provide recent evidence suggesting that during the first months postpartum infants go through a ‘sensitive window’ of heightened acceptance of the flavors experienced in the milk they are fed.

A basic understanding of the development and functioning of the chemical senses may assist in developing evidence-based strategies to improve children’s diets, since many of the illnesses that plague modern society (e.g. obesity, diabetes, and hypertension) are, in part, the consequence of poor food choices. The combination of repeated exposures to a wide variety of healthy foods and social modeling of healthful eating behaviors by parents will modify their children’s food preferences and will set the stage for the adoption of healthy eating habits. Helping parents to understand the basic biology underlying their children’s food preferences (table 1), and the ways in which they can effectively modify these preferences, should be a priority for prevention efforts.

References