
© PhotoDisc

CHAPTER 2

Determinants of Food Choice and Dietary Change: Implications for Nutrition Education

OVERVIEW

This chapter provides readers with an overview of the numerous influences on food choice and dietary practices. Understanding these influences will help nutrition educators design appropriate and relevant nutrition education. These influences are called determinants. The chapter also provides a description of the desired competencies outlined by professional nutrition societies for nutrition educators.

CHAPTER OUTLINE

- Determinants of food choice and diet-related behavior: an overview
- Food-related determinants: biology and experience
- Person-related determinants
- Social and environmental determinants
- What does all this mean for nutrition educators?
- Implications for competencies and skills needed by nutrition educators
- Summary

LEARNING OBJECTIVES

At the end of the chapter, you should be able to:

- Describe the research evidence for the influences of biological predispositions, experience with food, personal factors, and environmental factors on human food choice and dietary behaviors
- Understand the key role of intra- and interpersonal processes in food choice and dietary behaviors
- Appreciate the importance of these understandings for designing effective nutrition education
- State the competencies needed to be an effective nutrition educator

Determinants of Food Choice and Diet-Related Behavior: An Overview

You have known a person like Alicia: she knows a lot about nutrition, and, in particular, she knows that she should eat more fruits and vegetables. She just can't seem to do it. Or Ray, who wants to lose weight and knows what he is supposed to do, but just can't seem to get to it. Or maybe it is yourself—there is some eating habit you want to change but don't.

Nutrition education is often seen as the process of translating the findings of nutrition science to various audiences using methods from the fields of education and communication. If only the public knew all that we did, nutrition educators think, surely they would eat better. Thus, we believe that our task as nutrition educators is solely to provide the public with the information needed to eat well. We plan sessions on our government's food guide such as the United States' MyPlate and food label reading. We provide lists of high-fat or high-fiber foods, or food sources of nutrients such as calcium or vitamins. We discuss managing food budgets. However, studies show that simply communicating this kind of information is not enough. It is not motivating. People often know how to eat well but do not—just like Alicia and Ray.

This is because eating is about more than health. Eating is a source of pleasure and is related to many of life's social functions. Brillat-Savarin enthusiastically wrote an entire book on taste 200 years ago in which he noted that, "Taste, such as Nature has given to us, is yet one of our senses . . . that, all things considered, procures to us the greatest of enjoyment, because: the pleasure of eating is the only one that, taken in moderation, is never followed by fatigue; it can be combined with all our other pleasures, and even console us for their absence . . ." (Brillat-Savarin 1825). Eating behaviors are acquired over a lifetime, and are embedded in so many aspects of our lives. Unlike other health-related behaviors such as smoking, eating is not optional. We have to eat, and any changes we make are undertaken with a great deal of ambivalence. We want to eat to satisfy physical hunger and psychological desires and yet also want to be healthy, which may require adopting eating patterns that conflict with these desires.

We make decisions about food several times a day: when to eat, what to eat, with whom, and how much. Whether the act of eating is a meal or a snack, at home or at work, the decisions are complex and the influences many. Biologically determined behavioral predispositions such as liking of specific tastes are, of course, important influences. However, these can be modified by experience with food as well as by various intrapersonal and interpersonal factors. In addition, the environment either facilitates or impedes our ability to act on our biological predispositions, preferences, or personal imperatives. The influences are so numerous that they become overwhelming to try to understand. Yet understand we must if we want to be effective nutrition educators or communicators. It is very important for us to understand people, their behaviors, and the various forces that influence an individual's or a community's decision to eat in a particular way. This chapter simplifies matters by examining these influences in three categories that are commonly used in studying food choice or food selection: factors related to food, to the individuals making the choices, and to the external physical and social environment—factors related to food, person, and environment (Shepherd 1999).

Many factors within each of these categories influence our eating. These influences on our food choices or decisions are explored in greater detail in the following sections. We will call these influences *determinants*.

Food-Related Determinants: Biology and Experience

When asked, most people say their food choices are largely determined by "taste" (Clark 1998; Food Marketing Institute [FMI] 2012). By taste, they mean flavor, which includes smell and the oral perception of food texture as well (Small and Prescott 2005). Our sensory and emotional responses to the taste, smell, sight, and texture of food are a major influence on food preferences and food choices. What are we born with and what is learned?

BIOLOGICALLY DETERMINED BEHAVIORAL PREDISPOSITIONS

The Basic Tastes

Humans are born with biological predispositions toward liking the sweet taste and rejecting sour and bitter tastes (Desor, Mahler, and Greene 1977; Beauchamp and Mennella 2011; Gravina, Yep, and Khan 2013). The liking for the sweet taste remains throughout life and appears to be universal to all cultures (Drewnowski et al. 2012).

The liking for salt seems to develop several months after birth, when infants have matured somewhat (Mattes 1997). It has been suggested that these predispositions may have had adaptive value: the liking for the sweet taste because it signals a safe carbohydrate source of calories and the rejection of bitterness because it may signal potential poisons.

A fifth taste has been identified: umami, a Japanese word for deliciousness, which is associated with a savory taste such as the brothiness of soup or the meatiness in mushrooms. It seems to be related to glutamate, an amino acid, and may capture the taste of protein in food (Beauchamp 2009). In addition, because some taste buds are surrounded by free nerve endings of the trigeminal nerve, people are able to experience the burn from hot peppers and the coolness of menthol (Breslin and Spector 2008).

Preference for fat may have a genetic basis as well (Mattes 2009; Gravina, Yep, and Khan 2013). Fat is less a flavor than a contributor to texture (Mattes 2009) although some genes are thought to be related to the fat taste (Breslin and Spector 2008; Tucker, Mattes, and Running, 2014). It imparts different textures to different foods: it makes dairy products such as ice cream seem creamy, meat juicy and tender, pastries flaky, and cakes moist. Many high-fat foods are those in which fat is paired with sugar (desserts) or salt (potato chips), enhancing their palatability. Foods containing fat are more varied, rich tasting, and higher in energy density than are nonfat foods and hence are more appealing.

Individual Differences: Nontasters and Supertasters

Some genetic differences in sensitivity to tastes exist between individuals. Research shows that people differ in their responses to two bitter compounds called phenylthiocarbamide (PTC) and 6-*n*-propylthiouracil (PROP). When given PTC-impregnated paper or PROP in liquid form, some people cannot taste it and are labeled nontasters, others are medium tasters, and still others are supertasters (Tepper 2008; Lipchock et al. 2013). Such differences between individuals may be related to differences in being able to discriminate between different foods and may contribute to some of the differences in liking for certain foods (Duffy and Bartoshuk 2000; Tepper 2008).

Hunger and Fullness or "Satiety"

Many genetic and biological mechanisms control our feelings of hunger and fullness (called satiety), ensuring that people will eat enough to meet their energy needs (de Castro 2010). Throughout most of human history, getting enough food was the primary challenge. The human body developed to function in an environment where food was scarce and high levels of physical activity were mandatory for survival. This situation resulted in the development of various physiological mechanisms that encourage the body to deposit energy (i.e., fat) and defend against energy loss (Konner and Eaton 2010; Chakravarthy and Booth 2004). Today's environment, however, is one in which for many countries in the world and increasingly for others, food is widely available, inexpensive, and often high in energy density, while little physical activity is required for daily living. Researchers have proposed that the "modern environment has taken body weight control from an unconscious process to one that requires substantial cognitive effort. In the current environment, people who are not devoting substantial conscious effort to managing body weight are probably gaining weight" (Peters et al. 2002). This means that nutrition education has an important role.

Specific Tastes or Sensory-Specific Satiety

Humans also appear to have a built-in biologically determined mechanism whereby we get tired of one taste and move on to another one over a short time span, such as while eating a meal (Rolls 2000). This mechanism is called *sensory-specific satiety*. Such a mechanism probably had adaptive value for humans because it ensures that people eat a variety of different-tasting foods and thus obtain

A combination of fat, salt, and sugar can make foods very attractive to eat in large quantities.

© StaffordStudios/iStock

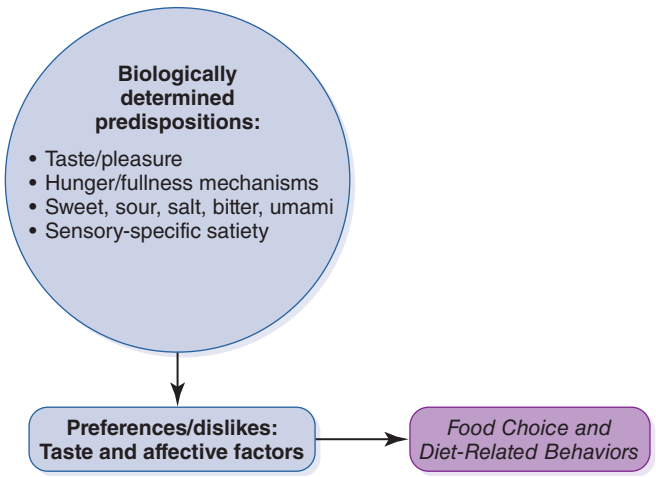


FIGURE 2-1 Our biologically determined behavioral predispositions influence food choices and dietary behaviors.

all the nutrients they need from these foods. Studies also reveal that for adults, the variety of foods available influences meal size, with greater variety stimulating greater intake. Again, this mechanism might have been very useful in a situation where food was scarce. However, in today's food environment, the variety possible in meals may contribute to overweight.

These biologically determined predispositions contribute to some degree to preference and to food choices or food selections and behavior, particularly in children, and are shown in **FIGURE 2-1**. In today's food marketplace, food products are being specially formulated to take advantage of these biological predispositions by manipulating their fat, salt, and sugar content to make them more desirable (Gearhardt et al. 2011; Moss 2013). However, as we see in the next section, these biological predispositions can be modified and most specific preferences are actually learned or conditioned—which is good news for nutrition educators because that means they can be modified.

EXPERIENCE WITH FOOD

Research in this area suggests that people's liking for specific foods and their food acceptance patterns are largely learned (Birch 1999, 2014; Birch and Anzman-Frasca 2011a; Mennella and Beauchamp 2005; Beauchamp and Mennella 2009). Thus, what humans seem to inherit primarily is the innate capacity to learn about the consequences of eating particular foods. Learning, in this context, does not mean cognitive learning, but rather *physiological learning* or *conditioning* arising from the positive or negative consequences that people experience physically and emotionally from repeated exposure to a food.

Pre- and Postnatal Experience

Such learning begins early, even prenatally. Flavors such as garlic and alcohol have been detected in mothers' milk, possibly familiarizing infants with these flavors (Beauchamp and Mennella 2009, 2011). In one study, breastfed infants whose mothers were fed carrot juice during pregnancy or during lactation or breastfeeding showed increased acceptance of carrot flavor in their cereal at weaning (Mennella, Jagnow, and Beauchamp 2001). In another study, infants who were fed a formula made of an unpleasant-tasting, sour and bitter protein (hydrosylate) from birth (from necessity because they did not tolerate milk) drank it well when tested with the hydrosylate formula at 7 months, whereas those fed milk formula rejected it (Mennella, Griffin, and Beauchamp 2004). Infants fed hydrosylate liked sour tastes into early childhood (Liem and Mennella 2002). There appear to be sensitive periods during which early experience has more impact on flavor learning (Trabulsi and Mennella 2012).

Learning from the Physiological Consequences of Eating: Preferences and Aversions

How humans feel physiologically after eating a food can have a powerful impact on food preferences. If eating is followed by negative effects, such as a feeling of nausea, a conditioned aversion follows. Conditioned aversions can be quite powerful. A one-time experience of illness following eating a food can turn us off that food for decades. On the other hand, liking for foods usually develops more slowly through a process of learned or conditioned preference, whereby repeated eating of a food, or familiarity, is followed by pleasant consequences such as a feeling of fullness or satiety.

Conditioning of food preferences continues throughout our lives, but early experience with food and eating is especially crucial in the development of eating patterns, in terms of both the kinds of food we come to like and the amount we eat. Experience with food influences the development of eating patterns of children and adults in several ways.

Exposure, Familiarity, and Learning to Accept New Foods

Humans, like other omnivores, experience the "omnivore's dilemma": we need to seek variety in our diets to meet

nutritional requirements, but ingesting new substances can be potentially dangerous (Rozin 1988). This dilemma can be resolved through familiarity and conditioning as described in the following sections.

Neophobia and Picky/Fussy Eating

Although food neophobia, or negative reactions to new foods, is minimal in infants, it increases through early childhood so that 2- to 5-year-olds, like other young omnivores, demonstrate neophobia (Birch 1999; Dovey et al. 2008). This would have adaptive value because infants are fed by adults, whereas toddlers are beginning to explore their world and have not learned yet what is safe to eat and what is not. However, neophobia can be reduced by repeated opportunities to sample new foods, sometimes requiring 6–12 or more exposures (Savage, Fisher, and Birch 2007; Anzman-Frasca et al. 2012), and probably through a "learned safety mechanism." That is, when eating a food is not followed by negative consequences, the child learns it is safe to eat and increased food acceptance results. Once the foods are familiar, the preferences tend to persist (Skinner et al. 2002). In addition, tasting or actual ingestion has been found to be necessary—not just looking at or smelling the food (Savage et al. 2007). Picky or fussy eating is somewhat different—it is the rejection of a large proportion of familiar (as well as new or novel) foods, tending to result in a diet that is lower in variety (Dovey et al. 2008). This quality tends to persist, even into adulthood, and may have a genetic component. Here, even more frequent food exposures may be necessary for acceptance to occur, presenting a challenge to parents and nutrition educators alike.

Neophobia increases through early childhood.

© djedzura/iStock/Thinkstock

In sum, with repeated consumption, preference for initially novel foods tends to increase. Thus, if children are exposed to many high-sugar, high-fat, and high-salt foods at home, at school, and in other settings, then these foods will become more familiar and will become preferred over those that remain relatively unfamiliar, such as vegetables or whole grains (Birch and Anzman-Frasca 2011a).

Experience with Food and the Basic Tastes

Biologically determined behavioral propensities can be modified by experience in adults as well (Pliner, Pelchat, and Grabski 1993; Pelchat and Pliner 1995). For example, those who eat lower-salt diets come to like them more (Mattes 1997). The dislike for bitterness can be overcome, as shown by the study described earlier where infants, with experience, comfortably consumed the bitter protein hydrosylate and by the fact that people come to like a variety of bitter tastes, such as coffee, dark chocolate, or bitter vegetables such as broccoli. Sour tastes, such as vinegar and grapefruit, can also become liked. Likewise, the liking for dietary fat can be modified. Studies have found that those who switched from a high-fat diet to naturally low-fat foods such as grains and vegetables (Mattes 1993) or to reduced-fat foods (Ledikwe et al. 2007) came to like the fat taste less. Maintaining these changed preferences involved continuing to eat these new foods.

Learning What Fullness Means: Conditioned Satiety

Research shows that in both young children and adults, a feeling of fullness or satiety is also influenced by associative conditioning or learning (Birch et al. 1987; Birch and Fisher 1995). The ability of our bodies to learn about how full familiar foods can make us feel may explain how it is that we end meals most often before we have yet experienced the physiological cues that signal satiety. Thus, as a result of repeatedly consuming familiar foods, people's bodies recognize the "filling" and the "fattening" quality of familiar foods and normally make adjustments in what they eat in anticipation of the end of the meal (Stunkard 1975). This is supported by the repeated observations that portion size is influenced by outside events, such as serving size, size of plate, and so forth (Fisher and Kjal 2008; DiSantis et al. 2013).

Our Preference for Calorie-Dense Foods

Humans seem to prefer calorie-dense foods over calorie-dilute versions of the same foods (Birch 1992; Birch and Fisher 1995). The biological mechanism that assists us to like calorie-dense foods was very adaptive when food, and especially calorie-dense food, was scarce and probably explains the universal liking for calorie-dense foods in adults. The finding that tasty high-fat and high-sugar foods induce overeating and obesity in animals (Sclafani and Ackroff 2004, Birch and Anzman-Frasca 2011b) suggests that this feature is less adaptive for humans in today's environment, where calorie-dense foods are widely available.

LEARNING FROM SOCIAL-AFFECTIVE CONTEXT: SOCIAL CONDITIONING

The emotional context, called the social-affective context, of eating also has a powerful impact on food preferences and on the regulation of how much people eat. Food is eaten many times a day, providing opportunities for individuals' emotional responses to the social context of eating to become associated with the specific foods being eaten. This is particularly true in children.

Social Modeling

Children learn about food not only from the direct experience of eating, but also from observing the behaviors of peers and adults (Birch 1999). Familiar adults have been found to be more effective than unfamiliar ones, and having the adults themselves eat the same foods is more effective than when adults offer the foods without eating the foods themselves (Harper and Sanders 1975; Addessi et al. 2005). Food preferences also increase when adults offer the foods in a friendly way (Birch 1999).

Parenting Practices

Parents not only provide genes, but also create a home environment that plays a critical role in shaping children's food preferences, eating behaviors, and energy intake (Savage, Fisher, and Birch 2007; Frankel et al. 2012). Children learn what, when, and how much to eat based on the transmission of cultural and family beliefs, attitudes, and practices. Parenting practices are specific parental actions or behaviors that are designed to influence children's eating behaviors and nourishment. Parents shape children's eating behaviors by the foods they make accessible to children (as food providers), by their own eating styles (as role models), how they discipline their children around food issues, and their actual child feeding practices. These feeding practices may be carried out not only by parents, but also by family and other caregivers, and these practices can encourage healthful eating or modify and interfere with the child's ability to respond to food appropriately.

Parents as Providers of Food

Exposure and accessibility. Parents can shape their children's food preferences by frequently exposing them to healthy foods at home and making them more easily accessible. Putting fruits and vegetables in a place where the child can easily reach them (e.g., in a bowl on the table or on a lower shelf in the refrigerator) and preparing them into sizes that are easy to eat (e.g., fruit cut into bite-size pieces) may increase the child's intake of these foods (Baranowski, Cullen, and Baranowski 1999).

Portion sizes. While very young children seem to be able to adjust their intakes to some extent over time (Cecil et al. 2005), recent studies show that portion sizes influence the amount eaten by children as young as 2 years of age (Fisher 2007; Birch, Savage, and Fisher 2015). Many parents apparently are not concerned about portion sizes for their children (Croker, Sweetman, and Cooke 2009) and yet there are many studies of meals with energy-dense foods that show that the larger the portion size, the more is consumed (Fisher and Kjal 2008; Fisher et al. 2007). In addition, when children are allowed to serve themselves, they tend to eat more (Savage et al. 2012). Thus, parents need to learn more about age-appropriate serving sizes and offer these to children. The good news is that serving vegetables as a soup or first course at the beginning of a meal (Spill et al. 2010, 2011) or placing large amounts of fruits and vegetables on the dinner plate also increases consumption of these items (Mathias et al. 2012).

Parents as Role Models

Parents can indirectly influence their children's eating habits by modeling good eating behaviors. Evidence suggests that parents who eat fruits and vegetables and other healthy foods have children who eat more healthfully (Fisher et al. 2002). The impact of role modeling may be enhanced by positive comments that are tied to the food. Unfortunately, modeling of negative behaviors can have an equally strong, but opposite effect and has been associated with the development of emotional eating,

excessive snacking, and body dissatisfaction (Brown and Ogden 2004). Thus, parents and caregivers who offer healthful foods in appropriate portion sizes and enjoy the foods themselves are likely to facilitate healthful eating in their children.

Prompting to Eat Healthful Food and Restricting Access to Less Healthful Food

Prompting or encouraging children to eat healthful foods and restricting less healthful foods are behaviors widely practiced by parents (Savage et al. 2007; O'Connor et al. 2009; Carnell et al. 2011). The relationship of these practices of parents and caregivers to children's preferences and intakes are quite complex (Blisset 2011). Often parents do not trust that their child will select the right kinds and amounts of food and feel that they need to help the child along (Savage et al. 2007). Some research suggests the excessive use of pressure to eat specific—usually healthy—foods is associated with lower intakes and more negative comments about those pressured foods. However, the middle ground of encouragement or prompts to try new foods, in particular vegetables, such as to take at least one bite, may be effective in increasing intake and preference (Blisset 2011). Likewise, very high levels of restriction of children's access or intake of specific foods, usually those that are most tasty because of their high sugar, fat, and/or salt content, may increase preference for and consumption of these items (Savage et al. 2007). Again, a middle ground of mealtime rules and limits on unhealthy snacks seems to be effective.

Interviews with parents suggest that they use a variety of practical strategies to encourage their children to eat healthfully (Carnell et al. 2011; Blisset 2011; O'Connor et al. 2010). These include presenting foods in an attractive way, verbal encouragement, playing games with the child, making eating healthful foods fun, use of teachable moments, involving the child, and flexible responses to individual differences shown by children.

Rewards

The use of rewards is another very common but controversial practice of parents (Ventura and Birch 2008). There is concern that rewards might reduce reasoned action and intrinsic motivation. And indeed, some studies suggested that using rewards did not increase liking for the foods and actually decreased liking. However, these items tended to be those that were initially moderately liked items such as fruits and sweet drinks. There is evidence that non-food tangible rewards (e.g., stickers) or non-tangible rewards (praise) can be highly effective in encouraging children to taste new or initially moderately disliked foods such as vegetables sufficiently often so that children become familiar with the foods and benefit from the familiarity effect (Cooke et al. 2011b).

For example, some studies found that exposure plus rewards increased the liking and intake for the targeted vegetables (Wardle et al. 2003; Remington et al. 2012). In a peer-modeling and reward-based intervention, children aged 4–11 years watched video adventures of heroic cartoon characters eating fruits and vegetables, and were given rewards for tasting the fruits and vegetables that the cartoon models ate. Liking for both fruits and vegetables increased significantly, as did consumption, both immediately after the intervention and at 4-month follow-up after gradual withdrawal of the rewards (Horne et al. 2004, 2011). Social rewards (praise) can be more effective than tangible rewards (Cooke et al. 2011a). Incentives offered in the school context have also increased intake of fruits and vegetables (Hendy, Williams, and Camise 2005). These findings suggest that judicious use of rewards can facilitate healthy eating by getting children to at least try new or initially disliked foods and hence become familiar with them (Cooke et al. 2011a).

Parental Feeding Styles

Parents influence their children's eating not only by their practices but also by their feeding styles. By *parenting feeding styles* we mean the attitudes and beliefs of parents that create the socio-emotional climate in which parenting practices are carried out (Rhee 2008; Blisset 2011). Parental feeding styles vary on the dimensions of responsiveness to the child (warmth and nurturance) versus control (expectations and demands) (Hughes et al. 2005; Blissett 2011). The *authoritarian* feeding style involves high demands and encourages eating using highly controlling behaviors or strict rules, threats, or bribes, with little regard for the child's needs (low in warmth and unresponsive to the child). The *authoritative* style is typified by high demands of the child's diet and eating behavior with a clear set of boundaries, but also by high warmth and sensitivity to child needs. It involves actively encouraging eating through non-directive and supportive behaviors, such as reasoning with the child or explaining why it is important to eat vegetables. By contrast, the *permissive parenting styles* impose little control or demands. There are two

types, one where parents are overly *indulgent* (expressing warmth and responsiveness to child needs) and another where parents are *uninvolved/neglectful* (lacking warmth and responsiveness and indifferent to child needs).

There has been considerable concern that the *authoritarian* or controlling feeding style may be detrimental to child healthful eating. Indeed, it has been negatively associated with parents offering and children eating vegetables (Patrick et al. 2005). However, the relationship with child weight is mixed. Some studies have found an association with higher weights of children (Faith et al. 2004; Rhee 2008; Ventura and Birch 2008), and others found that authoritarian parents are equally likely to have normal weight children as overweight children (Robinson et al. 2001; Pai and Contento 2014). On the other hand, the authoritative feeding style, where there are clear boundaries and the child is encouraged to eat healthful foods, but where the child is also given some choice about eating options, all in a warm emotional atmosphere, has been shown to be associated with increased consumption of dairy and vegetables and decreased consumption of sweet drinks (Patrick et al. 2005; O'Connor et al. 2010; van der Horst et al. 2007).

The *permissive* parental feeding styles (both *indulgent* and *uninvolved*) appear to be the most problematic. They are related negatively to children's intake of fruits and vegetables (Blisset 2011) and nutrition-rich foods such as 100% juice, fruit, vegetables, and dairy foods (Hoerr et al. 2009). Permissive styles, in particular the indulgent style, are also most associated with higher levels of overweight in several cultural groups (Rhee 2008; Hughes et al. 2008; Pai and Contento 2014).

In reality, parents use a mixture of styles (although one or another style may dominate) and parenting styles and practices are closely interconnected (O'Connor et al. 2010; Carnell et al. 2011).

Clearly neither too much nor too little control is effective. Encouragement to eat healthy foods is desirable, as are clear boundaries. It is the emotional tone and the way these practices are carried out that is the issue. The authoritative style seems to work best. It is typified by non-controlling practices that encourage healthful eating but do not force consumption, accompanied by moderately restrictive practices about eating less healthful foods and snacks, all in a climate of emotional warmth and sensitivity to the child (Blisset 2011; O'Connor et al. 2010; Satter 2000).

SUMMARY OF OUR EXPERIENCE WITH FOOD

Biologically determined behavioral propensities, physiological mechanisms, and conditioning through experience with food all influence people's sensory experience of food and food preferences. These influences are summarized in **FIGURE 2-2**. Given that energy-dense, high-fat, high-sugar foods are widely available in the environment, tend to be used as rewards, are most often offered in positive social

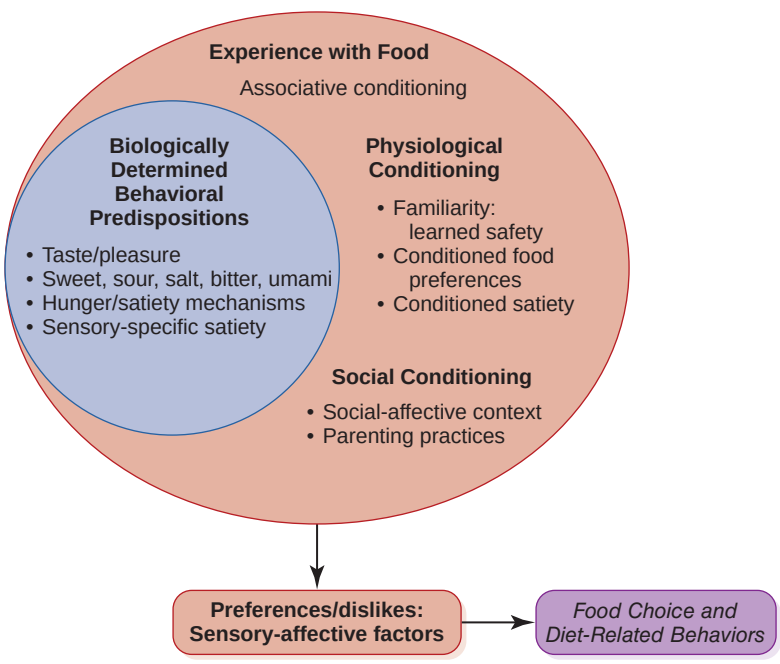


FIGURE 2-2 Our experiences with food influence our food choices and dietary behaviors.

contexts such as celebrations and holidays, are liked by other family members, satisfy biological predispositions, and produce positive feelings of being full, it is not surprising that they become highly preferred by adults and children alike. On the other hand, fewer opportunities are provided for people to learn to like whole grains, fruits, and vegetables in similar social contexts. When such opportunities are provided, children can develop liking for healthy foods such as vegetables (Anzman-Frasca et al. 2012). Practices that encourage healthful eating include making healthful foods available and accessible, offering encouragement to try them, setting boundaries but providing choices among them, and using strategies designed to facilitate acceptance but that are not excessively firm and controlling seem to work best for both children and adults.

Person-Related Determinants

Biology and personal experiences with food are not the only influences on individuals' food intake. Children tend to eat the foods they like and reject the foods they do not like in terms of taste, smell, or texture. However, as individuals become older, they also develop perceptions, expectations, and feelings about foods. These perceptions, attitudes, beliefs, values, emotions, and personal meanings are all powerful determinants of food choice and dietary behavior, as are individuals' interactions with others in their social environment. These influences or determinants are shown in **FIGURE 2-3**. They operate whether people are purchasing groceries at the store, choosing food when eating out, or making food at home.

INTRAPERSONAL DETERMINANTS

Perceptions, Beliefs, Attitudes, and Motivations

Our food choices and dietary practices are powerfully influenced by a variety of personal factors, such as our beliefs about what we will get from these choices. We want our foods to be tasty, convenient, affordable, filling, familiar, or comforting. Our food choices may be determined by the personal meanings we give to certain foods or practices, such as chicken soup when we are ill or chocolate when we feel self-indulgent. We may also be motivated by how the food will contribute to how we look, such as whether it will be fattening or, in contrast, good for our complexion. Our food- and nutrition-related behaviors are also determined

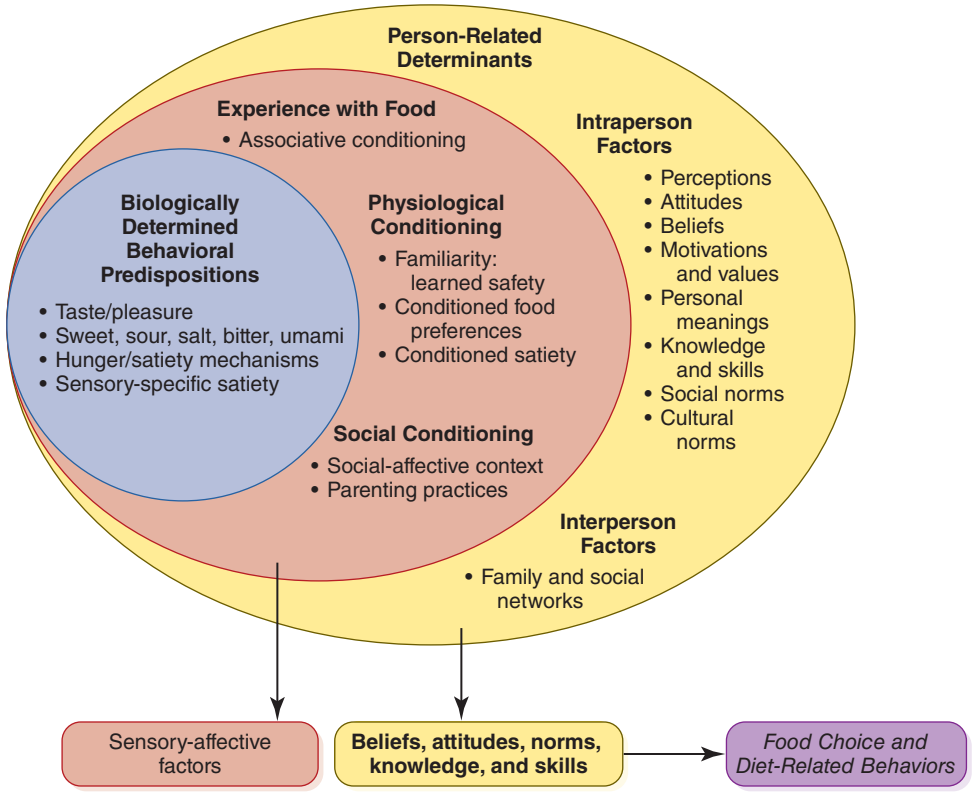


FIGURE 2-3 Intra- and interpersonal factors influence food choices and dietary behaviors.

by our attitudes toward them—for example, our attitudes toward breastfeeding or certain food safety practices.

Our identity in relation to food may also influence our behaviors. For example, some teenagers may see themselves as health conscious, but many others may see themselves as part of the junk-food-eating set. We may see that there are health benefits to eating more healthfully but may consider the barriers, such as high cost or the effort required to prepare the foods in healthful ways, just too great to take action. Or perhaps we lack confidence in preparing foods in ways that are tasty and healthful. Or again, we may have specific culturally related health beliefs that influence what we eat. For example, although the concepts of balance and moderation are common among many cultures, individuals may come from cultures in which foods are believed to have hot and cold qualities and must be eaten in such a way as to balance cold and hot body conditions. These cultural beliefs can have a major influence on food choices.

We come to value some aspects of food over others. In the United States, the major values in choosing foods are taste, convenience, and cost (Glanz et al. 1998; FMI 2012). In Europe, the major values are quality/freshness, price, nutritional value, and family preferences, in that order (Lennernas et al. 1997).

Food rejections are also highly influenced by psychological processes, based on both previous experience and beliefs. Rozin and Fallon (1987) place the motivations for rejecting foods into three main categories: (1) sensory-affective beliefs (e.g., the food will smell or taste bad) that lead to distaste; (2) anticipated consequences or beliefs about the possible harmful outcomes of eating certain foods (e.g., vomiting, disease, social disapproval), leading to danger; and (3) ideation or ideas about the origin or nature of foods, leading to disgust.

Knowledge regarding all these numerous person-related factors is crucial for nutrition educators so that we can better understand and assist our audiences to eat more healthfully (Krebs-Smith et al. 1995). Indeed the next three chapters are devoted to understanding these person-related influences on eating behavior and how we can use such understandings in nutrition education.

The Process of Choosing Foods

Response to Environmental Stimuli

Our thoughts and feelings interact with what we experience in the environment. For example, we may see a news story on the role of fruits and vegetables in reducing cancer risk, or a friend of ours develops colon cancer (external stimuli). We process such environmental stimuli or external events both cognitively and emotionally. These stimuli are filtered through a host of internal personal reactions of the kind listed previously, such as our perceptions, beliefs, values, expectations, or emotions, and together these filters determine what actions we will take. For example, we may process the idea of eating more fruits and vegetables in terms of taste, convenience, expected benefits, perceived barriers, or what our friends and relatives do, in addition to our concerns about getting cancer. Consequently, our decisions about whether to eat more fruits and vegetables to reduce cancer risk are based on our beliefs and knowledge about expected consequences (of eating fruits and vegetables), our motivations and values about desired consequences (reduced risk of cancer), and our personal meanings and values (with respect to developing cancer).

Trade-Offs

In the food choice process, most times we will also need to make trade-offs among various determinants or reasons for food choice, such as trade-offs among health considerations, taste, and cultural expectations. People may also trade off between items within a meal or between meals. For example, individuals may choose an item for its fillingness (e.g., a donut) but then balance it with something perceived as more healthful (e.g., orange juice). Individuals may choose a "healthy" dinner to balance what they consider to have been a less-than-healthful lunch (Contento et al. 2006).

Knowledge and Skills or Nutrition Literacy

People's nutrition literacy or food-related knowledge and skills also influence what they eat. For example, a national survey found that about one-third of individuals thought that the recommended number of servings of fruit and vegetables per day was two or three, and only about 20% thought it was five (National Cancer Institute 2007). Many consumers have difficulty judging the amounts of fat and number of calories in many common foods and in their own diets or knowing what an appropriate serving size should be (Brug, Glanz, and Kok 1997; Chandon and Wansink 2007). Health claims on product labels are hard to evaluate and the symbols used by different companies to indicate food ingredients in the package, such as fiber or

sugar, are hard to decode. Lack of skills in preparing foods also influences what individuals eat.

Social, Cultural, and Religious Norms

Humans are social creatures. We all live in a social and cultural context and experience society-wide social norms and cultural expectations, which can be extraordinarily powerful. We feel compelled to subscribe to these norms and expectations to varying degrees. For example, teenagers may feel pressure to eat less-nutritious fast food items in a choice situation with peers (e.g., after school), or individuals may experience family members' expectations that they will eat in a certain way. Whether to breastfeed may be influenced very much by the desires of a woman's family or her husband's family, depending on the culture. Being "large" has positive value in some societies. In the United States there is a saying: "you can never be too rich or too thin," especially when it comes to women. But in some societies, "people share goods, so no one is too rich, and friends share food, so no one is too thin" (Sobo 1997). Indeed weight gain, good appetite, and large stature are signs of good health, good social relations, generosity, and many friends. By contrast, weight loss, a small appetite, and thinness are considered signs of poor health, poor social relations, lack of friends, and meanness (the person did not share food when the person had it and so now the person has no friends to share food with him or her) (Rittenbaugh 1982; Sobo 1997).

Our perceptions of our status and roles in our communities are also important. The food choices and eating patterns of celebrities create social expectations for us all. What others in our community think are appropriate foods to eat in various situations may also create social pressures. Thus, our choice of foods may be heavily influenced by our perceptions of the social and cultural expectations of those around us.

INTERPERSONAL DETERMINANTS

Within societies, we all participate in a network of social relationships, the extensiveness and density of which vary among individuals (Israel and Rounds 1987). These networks involve family, peers, coworkers, and those in various organizations to which we belong. For example, in one study, food choices were 94% similar between spouses, 76–87% similar between adolescents and their parents, and 19% similar between adolescents and their peers (Feunekes et al. 1998). Food choices and eating patterns are also influenced by the need to negotiate with others in the family about what to buy or eat (Connors et al. 2001; Contento et al. 2006). Relationships with peers and those with whom we work also have an impact on our day-to-day choices (Devine et al. 2003).

Indeed, eating contexts and the management of social relationships in these numerous contexts play a major role in what people eat (Furst el al. 1996). For example, if a woman becomes motivated to reduce her fat intake by using nonfat milk instead of whole milk, she may find that other family members like whole milk and do not want to switch. She must decide whether to go along with family wishes or to buy low-fat milk separately for herself, which then becomes a barrier to change. Or the teenage son may have special food requests and the family needs to decide whether to accommodate the requests.

In addition to the impact of needing to manage social relationships within social networks, social support for healthy eating is also important, especially for those with long-term health conditions such as hypertension or diabetes where following special eating patterns has to be maintained indefinitely (Rosland et al. 2008).

Social and Environmental Determinants

Social and environmental factors are powerful influences on food choice and nutrition-related behaviors and must be considered by nutrition educators in planning programs.

PHYSICAL/BUILT ENVIRONMENT

The built environment includes all aspects of the environment that are modified by humans, including food outlets (e.g., grocery stores), homes, schools, workplaces, parks, industrial areas, and highways. There is a growing body of evidence that the built environments in relation to food and physical activity have important impacts on health (Sallis and Glanz 2009; Ding et al. 2013).

Food Availability, Accessibility, and Quality

In developed countries and increasingly in less developed countries, food and processed food products are available in an ever-widening array of choices. More than 40,000 food items are available in U.S. supermarkets, and

about 9,000 new brand name processed food products are introduced each year (FMI 2012, 2013). The typical shopper averages 2.2 trips to the supermarket each week (FMI 2013). Overall availability may be described as the array of food options that are present in the food system that are acceptable and affordable. Accessibility may be thought of as "immediate" availability, referring to the readiness and convenience of a food—whether the food requires little or no cooking, is packaged in a convenient way so that it can be eaten anywhere, or whether it can be stored for some time without spoilage. Food quality has many meanings, but here is used to refer to whether the foods were produced in an environmentally sustainable manner and are wholesome (Gussow 2006). Availability of such foods influences the quality and healthfulness of the diet.

Markets

Studies have shown that the availability of more healthful options in neighborhood grocery stores, such as fruits and vegetables or low-fat milk, is correlated with these foods being more available in homes, which in turn is related to a higher quality of food choices and intakes (Morland, Wing, and Diez Roux 2002; Powell et al. 2007; Boone-Heinonen et al. 2011). Thus, what is available in the community influences what is purchased and consumed. The availability and accessibility of fruits and vegetables at home and school enable their consumption by children (Hearn et al. 1998). Many low-income and minority neighborhoods have fewer supermarket chains that have a wider range of foods and cheaper prices. There is now discussion of "food deserts" to describe the lack of healthy foods at affordable prices in neighborhoods (Ver Ploeg et al. 2009; United States Department of Agriculture [USDA] 2012a). Just as important, and maybe more so, is the notion of "food swamps" or the overabundance of less healthy foods in neighborhood (Rose et al. 2009; Boone-Heinonen et al. 2011). Certainly youth report this as a major temptation to eat high-calorie food products and beverages and a barrier to healthful eating (Koch et al. 2015).

Accessibility also is dependent on where sources of food are physically located. Supermarkets, where a wide range of foods is available, may require transportation to reach, limiting the accessibility of food for many people, such as older people who are no longer able to drive or lower-income people without cars. The types of foods that are readily available in the local grocery stores, small corner stores, and restaurants within a given community depend on potential profits, consumer demand, and adequate storage and refrigeration facilities. The foods served or products stocked thus tend to be those that sell well, which are not always the most nutritious. Farmers' markets provide fresh, local foods but may require transportation to reach and are often only seasonal. Hence, some foods that are very important for health, such as fruits and vegetables, may not be readily accessible or are available only at a higher cost.

Workplaces, Schools, and Homes

Foods available at or near workplaces also tend to be those that are convenient, low in cost, and that sell well. In most schools, food is available and accessible. In the United States, the National School Lunch Program provides meals that conform to federal guidelines that specify nutritional standards. Participation in the program declines with age so that by high school two-thirds of students obtain their lunch from other sources. The majority of competitive foods in these other venues have been found to be high-fat and high-sugar items, including snack chips, candy, and soft drinks. In some countries commercial vendors provide meals for purchase. It has been shown that what is available in school environments affects the dietary behaviors of children (Briefel et al. 2009). Within the home, accessibility means that clean and safe water is easy to reach, a vegetable is not just available in the refrigerator but is already cut up and ready to eat, or fruit has been washed and is sitting on a table ready to eat. The limited accessibility of healthful, convenient foods in many settings may narrow good choices and make it difficult to eat healthfully.

Behavioral Economics and Environmental Change

In this context, nutrition educators can use behavioral economics principles in their work (Hanks, Just, and Wansink 2013; Wansink et al. 2012). Given that external cues can have a major effect on the food selected and the amount consumed, adjusting these factors can have a major impact on how much is eaten for a meal or snack. Here, we can implement changes to make the healthier options more attractive, convenient, and normative, which can nudge people to eat the healthier options. See Nutrition Education in Action 2-2, later in the chapter for how this approach is being used in school lunchrooms.

Built Environment and Physical Activity

The role of environmental determinants of physical activity has also been studied. The walkability of neighborhoods as well as the availability and accessibility of neighborhood safe parks, green spaces, and physical activity facilities have been shown to have some impact on physical activity or obesity of residents in those neighborhoods (Ferreira et al. 2007; Wendel-Vos et al. 2007).

Social and Cultural Environment

Social environments and cultural contexts are no less important than the physical environment. Social influences and cultural practices all influence food choice and dietary behavior (Rozin 1996).

Social Relations

Society has been described as a group of people interacting in a common territory who have shared institutions, characteristic relationships, and a common culture. Most eating occurs in the presence of other people. The effect can be positive or negative in terms of healthful eating, in part because family and friends serve as models as well as sources of peer pressure. For example, there is evidence that eating with others can lead to eating more food compared with eating alone, especially when the others are familiar people (de Castro 2000; Salvy et al. 2009). Spending more time at a meal eating with others also increases intake. Eating with others can result in pressure to eat higher-fat foods. On the other hand, eating with others can also result in pressure to try new foods that are healthy (MacIntosh 1996). Parents' own eating patterns likely influence those of their children (Fisher et al. 2002; Contento et al. 2006), and it has been shown that children and adolescents who eat with their families most days each week have better-quality diets than those who eat with their families less frequently (Gillman et al. 2000; Berge et al. 2013).

Cultural Practices and Family of Origin

Culture has been described as the knowledge, traditions, beliefs, values, and behavioral patterns that are developed, learned, shared, and transmitted by members of a group. It is a worldview that a group shares, and hence it influences perceptions about food and health. Cultural practices and family of origin have an important impact on food choices and eating practices even in modern, multiethnic societies where many different types of cuisine are available. Those from different regions of the country may have different practices. For example, for those from the American South a home-style meal is chicken-fried steak, mashed potatoes, corn bread, and bacon- and onion-laden green beans, with pie for dessert, whereas those who live in Texas may expect to eat barbecue or Tex-Mex foods that are hot and spicy. Those who have immigrated from different countries from around the world maintain some of their cultural practices in varying degrees, chief among them traditions that influence eating patterns. Religious practices also influence what is eaten (Satia-Abouta et al. 2002).

Most eating occurs in social settings.

© Monkey Business Images/ShutterStock, Inc.

Cultural rules often specify which foods are considered acceptable and preferable, and the amount and combination of various categories of foods that are appropriate for various occasions. The cultural practices of family and friends, especially at times of special celebrations and holidays, provide occasions to eat culturally or ethnically determined foods and reinforce the importance of these foods. If dietary recommendations based on health considerations conflict with family, cultural, and religious traditions, individuals who want to make dietary changes may find themselves having to think about and integrate their cultural expectations with their concern about their personal health. All of these considerations influence individuals' willingness and ability to make changes in their diets. These beliefs and practices must be carefully understood so that nutrition educators can become culturally competent and can design culturally sensitive nutrition education programs.

Social Structures and Policy

The organizations to which we belong can have a profound effect on our eating patterns. Some are voluntary organizations, such as religious, social, or community organizations; others include schools, our places of work, and professional associations to which we belong. The influence of these organizations comes from their social norms as well as their policies and practices. Local, state, and national government policy can govern and determine the availability and accessibility of opportunities for healthy eating and active living.

ECONOMIC ENVIRONMENT

Many factors in the economic environment influence food choices and dietary practices, among them the price of food, income, time, and formal education. Nutrition educators must consider these factors when designing nutrition education programs.

Price

Economic theory assumes that relative differences in prices can partially explain differences among individuals in terms of their food choices and dietary behaviors. The price of food as purchased is usually per item, by unit weight, or by volume. However, price can also be considered in terms of the amount of food energy obtained per dollar. Processed foods with added fats and sugar are cheaper to manufacture, transport, and store than are perishable meats, dairy products, and fresh produce. This is partly because sugar and fat on their own are both very inexpensive, which is in part a result of government agricultural policies. A diet made up of refined grains and processed foods with added sugar and fats can be quite inexpensive (a day's worth of calories for 2–3 dollars). Beans cost about the same, but animal protein sources may cost 5 to 10 times more per calorie, and fruits and vegetables (except potatoes and bananas) can cost some 50 to 100 times more per calorie than high-fat, high-sugar, mass-produced food products (Drewnowski 2012). Not surprisingly, low-income individuals eat fewer fruits and vegetables. These disparities in cost may also contribute to the higher prevalence of obesity in those of lower socioeconomic status.

This child was asked to draw a picture of her family eating their favorite meal together.

Courtesy of Cooking with Kids.

Income and Resources

People in the United States and United Kingdom spend only about 8–10% of their income on food, compared with 15% in Europe and Japan, 35% in middle-income countries, and 45–50% in low-income countries (Muhammad et al. 2011; USDA 2012b; *Washington State Magazine* 2013). However, this is an average. The amount of money spent on food depends on income level within a country. Upper-income individuals in the United States spend more money on food, but it is a smaller proportion of their income—about 8%. Lower-income households economize by buying discounted items and generic brands and thus spend less on food; despite this, food accounts for 25–35% of their income (Thompson 2013; U.S. Department of Labor 2013b). Compared with other economic variables, income has the strongest marginal impact (i.e., additional effect) on diet behavior: those with higher incomes eat a higher-quality diet (Macino, Lin, and Ballenger 2004). Other material resources also influence diet—those below certain poverty levels in many countries qualify for government assistance—such as free or reduced price meals for children at school, food coupons in some form, or direct cash aid (U.S. Department of Labor 2013b). These may improve the quality of diets.

In this context, statistics show that about 14.5% of American households are food insecure, meaning that they have limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways. Within this category, about 6% are very food insecure (USDA 2013).

Time Use and Household Structure

Surveys and time use diaries show that the amount of time people spend on food-related activity in the home depends

on many factors, including whether men or women are employed outside the home and whether they have children (Robinson and Godbey 1999). In the United States, women spend an average of 8 hours per week and men 5 hours in food preparation and cleanup activities (U.S. Department of Labor 2013a).

Time is scarce for all households, regardless of income. Many people with whom nutrition educators work today say they are too busy to prepare healthful foods or to cook at all. This is particularly true of low-income families who often work long hours. For some households, time constraints may limit personal investments in healthier behaviors. For example, it has been found that men and women who are married with children have a higher-quality diet than single parents, probably because they can share child care duties and thus are better able to attend to their own health (Macino, Lin, and Ballenger 2004). Nutrition educators need to consider these time constraints in the development of nutrition education interventions. (However, it should be noted that Americans spend an average of 25 hours per week watching television and another 3 hours per week on computer use for leisure.)

Educational Level

In general, more highly educated individuals eat a higher-quality diet and are less sedentary partly because they watch less TV (Macino et al. 2004). People with more education may be better able to obtain, process, interpret, and apply information that can make them more able to eat healthfully. They also may be more forward looking and optimistic about their future and thus willing to seek health information and make greater investments in their health (Macino et al. 2004).

Consumers are inundated with food choices at the supermarket.

Photo by Lyza, https://www.flickr.com/photos/lyza/49545547/in/photolist-5nWaz-9Gd5xM. Used under Creative Commons Attribution-ShareAlike 2.0 Generic.

Grocery Shopping Trends

The influences described earlier affect how people shop for food. Surveys of grocery shoppers have found that about one-third of shoppers are economizers, who are budget conscious and usually come from lower-income households. They plan weekly menus, check for sales, and use coupons. Another third are carefree spenders, who are the least price conscious and least likely to compare prices and use coupons. The final third are time-challenged shoppers who are obsessed with convenience because of their hectic, multitasking lifestyles. They have the largest households and are most likely to have preteen children (FMI 2012).

INFORMATION ENVIRONMENT

Knowing the information context of the audience is important for nutrition educators to design messages and programs that are appropriate (see **BOX 2-1**).

Media

The current media-saturated environment has undergone revolutionary changes in the past 2 decades, resulting in the availability to individuals and households of numerous television channels, radio stations, websites, and other emerging communication routes. Time spent on these various media is high: children aged 2–4 years are exposed to about 4 hours per day of various media. This increases to 8 hours per day in middle school, in consideration of the fact that adolescents often use several media simultaneously. Television viewing is dominant and increases to 25 hours per week through childhood and then declines somewhat in adolescence to 19 hours per week as music becomes more important. Adults spend about 15–17 hours per week on television viewing. The media are the main source of information about food and nutrition for many people, making them collectively a major source of informal nutrition education. Information about food and nutrition is now widely covered in newspaper articles, magazines, and television programs. Many magazines are devoted to health and nutrition, and entire channels on TV are devoted to food-related shows. As **NUTRITION EDUCATION IN ACTION 2-1** shows, media and other influences also affect the decisions mothers make with regard to their children.

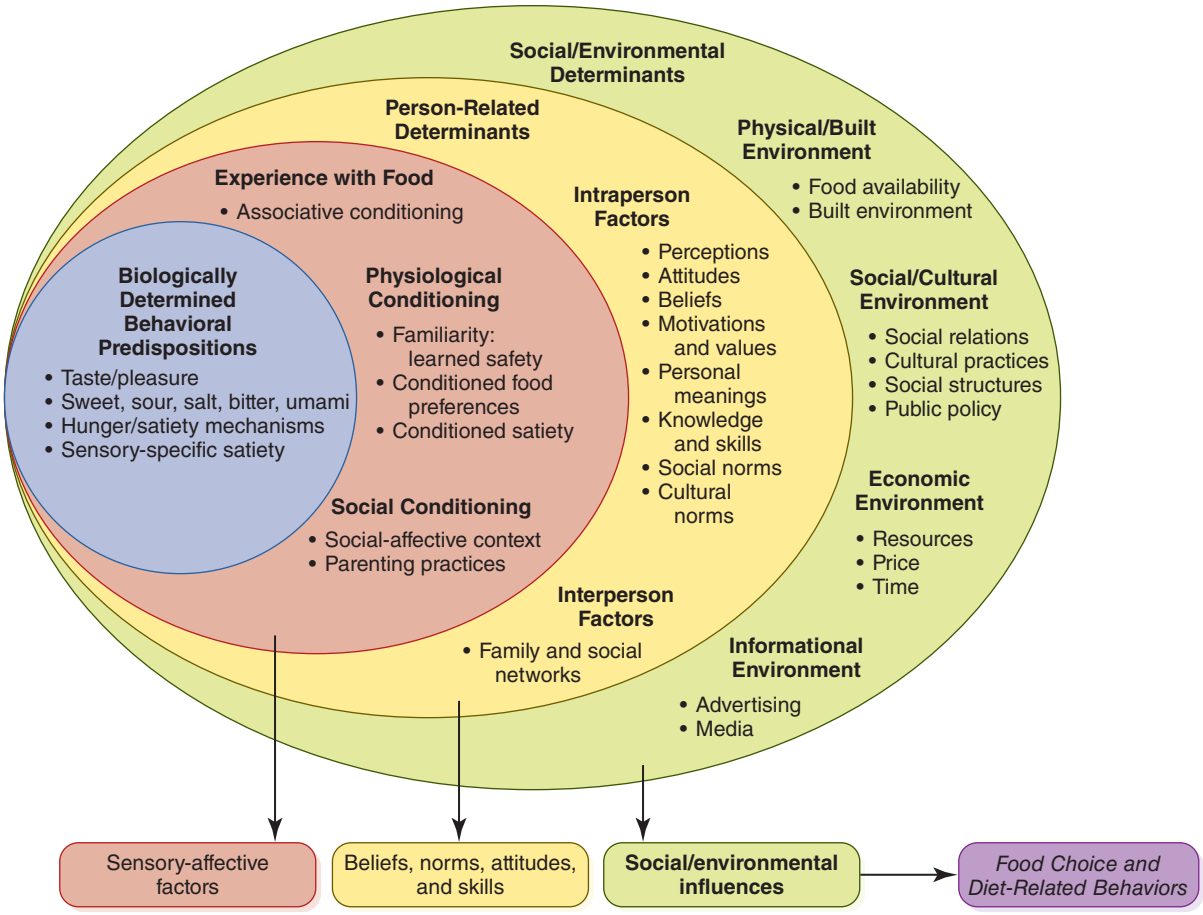


FIGURE 2-4 Social and environmental factors influence food choices and dietary behaviors.

Advertising

The media have demonstrated a powerful capacity to persuade. Today advertising occurs in a variety of venues such as magazines, the Internet, and video games as well as television. The U.S. food industry spends close to $10 billion per year on food marketing and advertising (Federal Trade Commission [FTC] 2012), with $1.8 billion aimed at children. Most of this is spent by companies that produce high-fat and high-sugar products that are highly processed and packaged; examples include $800 million for snack foods, $3.5 billion for beverages, and more than $3 billion for restaurants/fast foods (FTC 2012). Food advertising is strong in Europe and other countries as well (World Health Organization 2013). Information on the impact of marketing on sales of food products is not easily available because it is considered proprietary information. However, there is evidence that these marketing activities influence food choices (Story and French 2004; Institute of Medicine 2006). The ubiquity of advertising, together with the amount of time people spend watching television and being exposed to marketing, makes these influences considerable. The environmental influences on food choice and dietary behavior are summarized in **FIGURE 2-4**.

What Does All This Mean for Nutrition Educators?

It is important for nutrition educators to realize that many factors influence eating behavior and that nutrition education needs to develop strategies to address these influences, often referred to as *determinants* of behavior.

In Figure 2-4, a series of concentric circles schematically represents the ways in which biological, experiential, personal, social, and environmental determinants influence food choice and diet-related practices. No factor is independent of any other, rather, they are all related, each larger circle encompassing the influences of the smaller

BOX 2-1 Assessing our Audiences: A Checklist

We can use the information in this chapter to assess our audiences in order to ensure that our nutrition education is appropriately tailored to them. It is best to have some specific behavior changes in mind for this assessment, such as eating vegetables, breastfeeding, or managing diabetes:

Food-related determinants: biology and experience

- What are their favorite foods? Most disliked foods? Why?
- What are some comfort foods that they grew up with or are part of their culture? How important are these to them?
- How do they judge when they have had enough to eat?
- How willing are they to try new foods?

Person-related determinants

- What does the term [healthy eating] [eating vegetables] [breastfeeding] [buying sustainably produced foods] mean to them?
- How important is [healthy eating] [eating vegetables] [breastfeeding] [buying sustainably produced foods] to them?
- What are some culturally expected behaviors in relation to diet (and physical activity)?
- What are some diet-related behaviors expected of them because of their role or status (e.g., mothers, managers)?
- How motivated are they to make the changes in their diets (or physical activity patterns) toward recommendations?
- What skills do they have to make the changes in their diets (or physical activity patterns) toward recommendations?
- What family or social networks do they have that would be supportive of the behavior (or physical activity) changes they wish to make?

Social and environmental determinants

- How easily can they get the foods they need from the stores near them? What kinds of stores are these (e.g., supermarkets, small stores, etc.)?
- How satisfied are they with the quality of these foods?
- What kinds of practices from their culture are supportive of the changes they would like to make? Which practices could be improved?
- To what extent are foods available at or near their places of work supportive of healthful eating? Are the policies at work supportive of breastfeeding?
- Do they feel they have enough healthful food to feed their families throughout the month?
- If their income is low, are they eligible for food assistance programs? Which ones? How helpful are these for making the behavior changes they would like to make?
- What media do they watch or use? How much time do they spend on these in a typical week?
- What are their major sources of information for food, nutrition, or physical activity?

These questions are the basis of the assessment described in Chapter 8.

circles. These concentric circles reflect levels of influence or overlapping spheres of influence.

KNOWLEDGE OR NUTRITION LITERACY IS NOT ENOUGH

Knowledge is needed for people to be able to make wise choices and to take action. But Figure 2-4 shows us that knowledge is only one of many, many influences on, or determinants of, food choice and diet-related behaviors.

In addition, consumers in the United States often say they already know enough. For example, one survey found that 7 of 10 consumers said their diet needed some improvement. Guilt, worry, fear, helplessness, and anger were the primary emotions expressed about their diets. However, they said they knew enough about nutrition: "Don't tell us more" (IFIC Foundation 1999). Another survey found that about 25% said they "always" felt comfortable selecting healthy foods when grocery shopping and another 50% said "most of the time" (Supermarket News 2013).

Clearly, although many Americans say their diets need improvement, they also indicate that they are knowledgeable about nutrition and are just unable to change or are uninterested in changing. Thus, many other factors besides knowledge must influence or determine their food choices and diet-related behaviors. To be successful, nutrition education also must address these other determinants, which are discussed below in the three categories of food-related determinants; person-related determinants; and social and environmental determinants.

NUTRITION EDUCATION ADDRESSING FOOD-RELATED DETERMINANTS

Addressing food-related determinants is very important in nutrition education. Food is a powerful primary reinforcer that produces instant gratification in taste and a sense of satisfaction and fullness. Because taste or preference is also shaped by repeated experience with foods and eating, nutrition educators working with any age group need to create opportunities to offer nutritious and healthy foods such as fruits and vegetables frequently in a positive social-affective context so that individuals will come to like nutritious foods. Cooking and gardening experiences can be particularly helpful strategies because they provide opportunities for people to become familiar with and enjoy healthful foods and to learn how to make healthy foods taste good. Similarly, interventions to decrease the intake of food components such as fat or salt should help people adopt eating plans that include foods naturally low in these components for a long enough time that people can become used to them and come to like them. Indeed, in a long-term nutrition education intervention with women, those who were able to stay with a low-fat diet for 2 years or more were those who came to dislike the taste of fat (Bowen et al. 1994).

NUTRITION EDUCATION IN ACTION 2-1 Multiple Influences on Breastfeeding: A Study of Low-Income Mothers

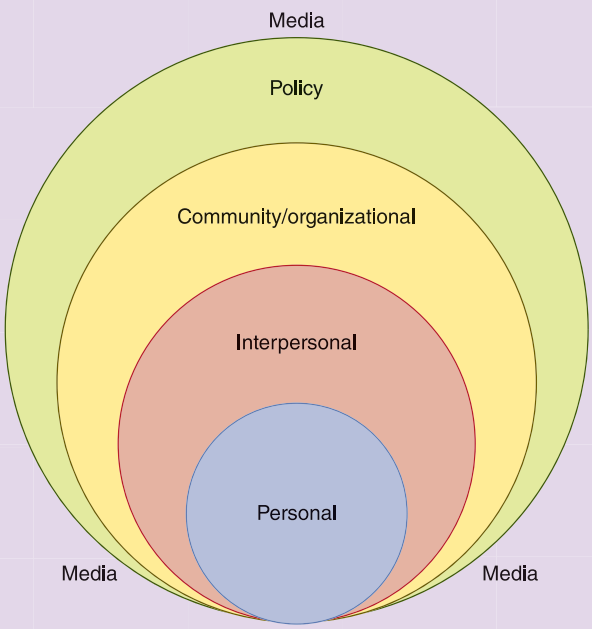
Media influences: TV shows and print media foster the perception that formula feeding is the norm whereas breastfeeding is not. Instead, women's breasts are used to advertise lingerie, perfume, or alcohol: these images influence personal beliefs.

Policy influences: There is legislation that supports breastfeeding in the work setting. Low income mothers receiving benefits need to work after a certain time, thus making breastfeeding difficult.

Community and organizational factors: Workplaces can be supportive or not. Baby-friendly hospitals can encourage breastfeeding, whereas free infant formula packages on discharge do not. Returning to work predicts quitting breastfeeding after having initiated it in the hospital.

Interpersonal factors: The father of the baby can be a major influence, followed by the mother's mother. Cultural beliefs are also a factor, such as the belief that women may not have enough milk, particularly when babies are "greedy."

Personal factors: Beliefs, knowledge, and skills. The study found that cultural beliefs positive to breastfeeding were often outweighed by personal beliefs or anticipation that breastfeeding would be painful. There also were concerns about the appropriateness of feeding in public settings because of sexual images in the media, or the disapproval of the baby's father.



Modified from Bentley, M. E., D. L. Dee, and J. L. Jensen. 2003. Breastfeeding among low-income, African-American women: Power, beliefs and decision-making. *Journal of Nutrition* 133:305S–309S. Used with permission of the American Society for Nutrition and the authors.

As nutrition educators, we can also work with families and caregivers in preschool and school settings to assist them to adopt practices that encourage healthful eating, such as making healthful foods available and easily accessible, modeling the desired behavior, serving age-appropriate serving sizes, providing healthful options and allowing the child to choose among them, encouraging children to taste the desired foods, using rewards appropriately so children can acquire preferences for healthful food, moderately restricting unhealthful snack foods, using teachable moments, and giving flexible responses to individual differences shown by children. Most of these practices work with adults as well.

NUTRITION EDUCATION ADDRESSING PERSON-RELATED DETERMINANTS

Although biological mechanisms and food-related experiences influence eating behaviors directly, psychological processes can be perhaps even more powerful. Individuals develop attitudes toward foods, values, feelings, beliefs, and personal meanings, and these intra- and interpersonal determinants also influence food choices and eating patterns. In fact, it is clear that such factors play a central role in food-related behaviors. As Epictetus said many hundreds of years ago, "We are troubled not so much by events themselves but by the views we take of them." This is good news for nutrition educators because these perceptions, attitudes, and beliefs are to some extent modifiable through education. Indeed, these perceptions and attitudes form a central focus of much of nutrition education.

NUTRITION EDUCATION ADDRESSING ENVIRONMENTAL DETERMINANTS

Nutrition education needs to address environmental factors by promoting the increased availability and accessibility of wholesome and healthful foods and active living options, and by taking into account the resources people have, their social networks and relationships, and the influence of media and advertising. Nutrition education must also address social structures and policy. However, we need to recognize that these environmental determinants are also filtered by people's attitudes, beliefs, and values, which in turn influence food choices and dietary behavior.

Availability: Reality and Perception

Availability, for example, means different things to different people. Recent immigrants may consider familiar food products "available" even if a long car or subway ride is needed to get to stores where the food is stocked. For others, a food is not available if it cannot be cooked in the microwave and ready to eat in 5 minutes. Such differences in the interpretation of availability influence individuals' food choices.

Economic Environment: Reality and Perception

Likewise, the economic environment is based on the analyses, values, and interpretations of individuals, all of which have an impact on dietary choices. Economics is a behavioral science based on the fundamental notion that human wants are infinitely expansible, whereas the means to satisfy them are finite. Human wants always exceed the means to satisfy them, and there is, therefore, scarcity. (This has been simplified to the statement that human greed is infinite whereas the means to satisfy that greed are finite.) Economics is the study of people's reaction to the fact of scarcity—how people make choices when they must choose among alternatives to satisfy their wants. Economics is concerned with desired scarce goods, not free goods, such as air in natural settings, because free goods do not present a problem of choice. Cost can be seen as the sacrifice, or what needs to be exchanged, to obtain what is desired. In this context, the full price of a food or dietary practice is not just its monetary price but includes all the costs or sacrifices individuals make, such as travel costs, time, or child-care costs while shopping. For example, a person may be willing to exchange money for time by purchasing a food that is already prepared. As nutrition educators, we need to learn about the sacrifices individuals are willing to make to engage in a healthy behavior. How willing are they to sacrifice convenience for more healthful meals?

Time: Reality and Perception

In the same way, time is both an objective feature of life and a perception. The time for food-related tasks such as cooking or eating can be easily quantified in hours and minutes. However, the *perception* of time and its worth to individuals for different tasks varies considerably. For example, the time required to make decisions about food has increased because information has become more complex. As we noted before, there are about 40,000 items

in a supermarket and about 9,000 new food items are introduced each year that people must learn about. No longer do people choose from three or four types of cold breakfast cereal, but instead from a whole supermarket aisle of cereals. This takes time.

In addition, people have become more avid consumers and consumption takes time: it takes time to use all the gadgets and objects that people have acquired, particularly electronic devices such as cell phones, music players, and televisions. To overcome the scarcity of time, people do more than one thing at once, multitasking. Add to that the economic necessity of two jobs for many and it is not surprising that the perception is that there is not just scarcity of time, but a time famine. This has impacts that are important for nutrition educators. For example, low-wage employed parents find there is spillover from working long hours into family food-related tasks (Devine et al. 2006). There is stress and fatigue; parents reduce the time and effort spent on family meals, they make trade-offs with other family needs, and they have to develop various time management strategies to cope. Nutrition educators need to be mindful of people's real and perceived economic and time constraints and how they make choices in light of these constraints. **NUTRITION EDUCATION IN ACTION 2-2** showcases programs that were created to work with economic and time constraints, and to use behavioral economics to help people eat better.

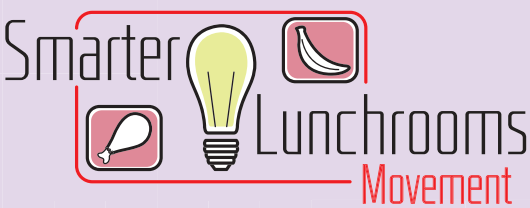
NUTRITION EDUCATION IN ACTION 2-2 Programs to Address Economic and Time Restraints

Barbershop Nutrition Education

Prostate cancer is twice as high in African American men as in white men. Eating fruits and vegetables may help to reduce risk. A novel site for nutrition education was the barbershop. A program was delivered to African American men while they were waiting for service. A set of five true or false statements was developed about the rate of prostate cancer in men and the role of fruits and vegetables in cancer risk reduction. The men were asked to answer them, and then the nutrition educator went over the answers. The men could keep the statements and the answer sheet. This simple intervention increased awareness of both prostate cancer and ways to reduce risk.

People at Work: 5-a-Day Tailgate Sessions

Because many people working in factories and other similar locations do not have time to go to a different site for nutrition education sessions, the nutrition educator can go to them. At one sawmill, the workers ate their lunches from coolers in their cars. The nutrition educator therefore met them in the parking lot and provided monthly tailgate sessions over the course of a year (including through the Midwestern winter), providing a different food each time that involved interesting ways to use fruits and vegetables (such as baked apples, chili, or vegetable wraps). The focus was on how to incorporate fruits and vegetables into meals and snacks. The results showed that the workers' interest and motivation were enhanced, as were skills in incorporating more fruits and vegetables in their diets.



Smarter Lunchroom is a Trademark of the Cornell Center for Behavioral Economics In Child Nutrition Programs. Used by permission.

Smarter Lunchrooms Movement in U.S. Schools

Children in the United States are usually served lunches in school, with reduced price and free meals available for those with low incomes. External cues can have a major effect on the food selected and the amount consumed. Adjusting these factors can have a major impact on how much is eaten for a meal or snack. In a behavioral economics approach, changes are made to these environmental factors to nudge children to eat the healthier options. For example, making items more *attractive* by changing the names, such as "X-ray Vision Carrots" and displaying fresh fruit attractively in bowls or baskets increases consumption. When healthful items are made more *convenient* by placing them in the front of the food line, students will choose them more often (Wansink et al. 2012; Hanks, Just, and Wansink 2013).

http://smarterlunchrooms.org

Summary: Nutrition Education Addresses Determinants of Behavior

In summary, people's perceptions and attitudes form a central focus of much of nutrition education. Thus, nutrition education can be seen as the process of addressing all the major categories of determinants, as shown in **FIGURE 2-5**, with personal perception interacting with all of them. Building on the contemporary definition of nutrition education, Figure 2-5 shows that nutrition education is directed at:

- *Biology and food experiences* by providing food tasting and cooking experiences to increase familiarity and preferences for healthy foods.
- *Person-related determinants* by providing audiences with educational experiences on *why-to* take action on healthy food choices and diet-related behaviors (through addressing people's perceptions, attitudes, norms and self-efficacy) and *how-to* take action (through addressing knowledge and skills).
- *Social/environmental determinants* by providing environmental and policy supports through facilitating opportunities for when and where to take action on healthy choices.

Exactly how nutrition education activities can address these determinants of food choice and dietary behaviors is described in detail in the remaining chapters in this book.

Implications for Competencies and Skills Needed by Nutrition Educators

Nutritionists and dietitians are well grounded in nutrition science and medical nutrition therapy and are anxious to transmit what they know to a variety of audiences in exciting ways. They are less well grounded in the social sciences, particularly the behavioral sciences and the field of communications. Yet as we have seen, food choices and dietary behaviors are determined by a multitude of factors. Understanding behavior and its context is crucial for effective nutrition education. Consequently, what the field needs is nutritionists who are sufficiently conversant with the relevant fields of behavioral science and communications to be able to design effective nutrition education programs. This book aims to help nutritionists develop these competencies.

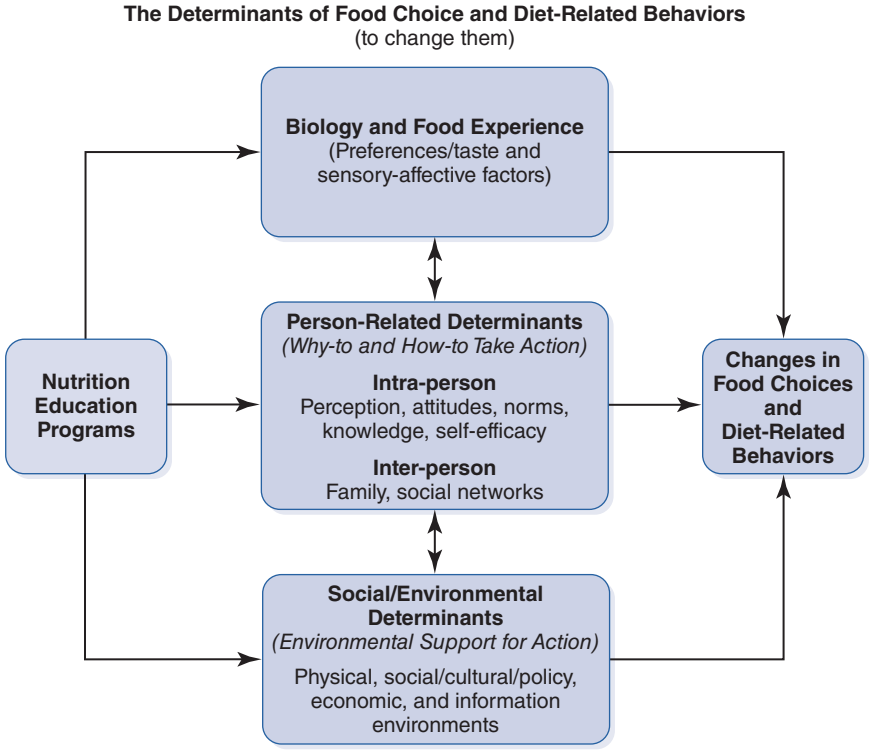


FIGURE 2-5 Nutrition education addresses the many determinants of behavior.

THE SOCIETY FOR NUTRITION EDUCATION AND BEHAVIOR'S COMPETENCIES FOR NUTRITION EDUCATION SPECIALISTS

The Society for Nutrition Education and Behavior is updating its list of competencies (SNEB 1987) that nutrition educators should have. The revised draft list is summarized below. Please check its website for the final updated list of competencies (www.sneb.org).

1. *Basic food and nutrition knowledge:* Describe the fundamentals of nutrition science, food groups and the dietary guidelines; ability to explain different types of nutrition-related study designs and accurately assess nutrition-related claims
2. *Nutrition across the life cycle:* Identify the primary dietary issues and challenges at different phases of the life cycle and use dietary guidelines to make recommendations
3. *Food science:* Identify the effects of food processing and culinary practices on food and best practices to address safe food handling
4. *Food policy:* Understanding the purpose, funding and implementation of various government food-related programs; the roles of government agencies in regulating food and dietary supplements
5. *Agriculture/food systems:* Describe the potential effects of differences in agricultural practices and various food processing, packaging, distribution, and marketing practices on food choices and food availability; explain effects of natural resources on the quantity and quality of the food and water supply
6. *Behavior and education: theory:* Describe the biological, psychological, social, cultural, political, and economic determinants of eating behavior; psychosocial theories of behavior and behavior change and apply them; and apply theory-based learning and instruction practices in nutrition education
7. *Nutrition education: implementation:* Assess population to design and evaluate nutrition education for all ages and diverse audiences using the following steps: determine the behavior change goals of the program; identify theory-based mediators and facilitators of behavior change, including social and environmental influences; select appropriate theoretical models; determine objectives to address mediators; select or design appropriate strategies/techniques; develop a budget; and design **evaluation** and assess progress
8. *Written, oral, and social media communication:* Communicate effectively with diverse audiences, both orally and in writing, and advocate effectively for nutrition education and healthy diets in various sectors
9. *Nutrition education research methods:* Analyze, evaluate, and interpret nutrition education research and apply it to practice

ACADEMY OF NUTRITION AND DIETETICS COMPETENCIES

The Academy of Nutrition and Dietetics' accreditation standards for the education of entry-level dietitians (Academy of Nutrition and Dietetics 2012) include some competencies that are related to nutrition education.

Core Knowledge for the Registered Dietitian

- The curriculum must include opportunities to develop a variety of communication skills sufficient for entry into pre-professional practice. (KRD 2.1)
  (Tip: Students must be able to demonstrate effective and professional oral and written communication and documentation.)
- The curriculum must include the role of environment, food, nutrition, and lifestyle choices in health promotion and disease prevention. (KRD 3.2)
  (Tip: Students must be able to develop interventions to affect change and enhance wellness in diverse individuals and groups.)
- The curriculum must include education and behavior change theories and techniques. (KRD 3.3)
  (Tip: Students must be able to develop an educational session or program/educational strategy for a target population.)
- The behavioral and social science foundation of the dietetics profession must be evident in the curriculum. Course content must include concepts of human behavior and diversity, such as psychology, sociology, or anthropology. (KRD 5.3)

Summary

People's food choices and nutrition-related practices are determined by many factors. This has consequences for nutrition education.

BIOLOGY AND PERSONAL EXPERIENCE WITH FOOD

Humans are born with biological predispositions toward liking the sweet, salty, and umami tastes and rejecting sour and bitter tastes. Some genetic differences exist between individuals in sensitivity to tastes, and these may influence food choices. However, individuals' preferences for specific foods and food acceptance patterns are largely learned from familiarity with these foods. People's liking for foods thus can be modified by repeated exposure to them. Sense of fullness is also learned.

- Check out the food preferences and prior experiences with food when you work with an audience. Provide food experiences to the extent that you can.

PERSON-RELATED DETERMINANTS

People acquire knowledge and develop perceptions, expectations, and feelings about foods. These perceptions, attitudes, beliefs, values, personal meanings, and perceived cultural norms are all powerful determinants of food choice and dietary behavior. Families, social networks, and cultural group also influence food choices.

- Conduct a thorough assessment of your audience before you design any nutrition education in terms of their beliefs, attitudes, values, cultural group membership, social networks, and food and nutrition-related knowledge and skills. Check out your own cultural competence.

SOCIAL/ENVIRONMENTAL DETERMINANTS

The physical/built environment influences the foods that are available and accessible as well as venues for active living such as walkable streets and attractive parks. Cultural practices, social structures, and social policies make it easier or harder to be healthy. The economic determinants of behavior include the price of food, income, time, and education. The information environment, including the media, is very powerful in influencing people's food choices.

- Understand fully the social, economic, and cultural settings of your audience so that the recommendations you provide are appropriate.

KNOWLEDGE AND SKILLS ARE NOT ENOUGH

Consequently, knowledge and skills are not enough for people to eat healthfully and live actively. Nutrition education must address these many other food, person, and environmental determinants of behavior if it is to be effective.

- Check that your sessions or intervention includes activities that address motivation as well as knowledge and skills and takes into account other influences on behavior.

CONSEQUENCES FOR THE SKILLS OF NUTRITION EDUCATORS

These considerations make it clear that nutrition educators need an additional set of skills beyond our knowledge of food and nutrition. We need to develop the skills to understand people, their behavior, and the context of their behavior in order to create programs to address these factors.

- Review your knowledge and skills as an educator and check what skills you still need to enhance.


© PhotoDisc

Questions and Activities

1. Think about the influences on your eating and physical activity behaviors and list them. Compare them to the categories of influences described in this chapter. Into which categories do the items on your list fall? Are there some surprises? How would you describe the motivations for your eating patterns?
2. List at least five biological predispositions people are born with, and describe each in a sentence or so. Are they modifiable? If so, provide the evidence. How can the information be useful to nutrition educators?
3. One often hears parents say that their child will just not eat certain healthful foods, such as vegetables.

They believe that such dislikes cannot be changed. Based on the evidence, what would you say to such a parent?

4. How can nutrition educators help young children learn to self-regulate the amount of food they eat?
5. "You can have dessert if you eat your spinach." Is this a strategy you would recommend to parents and child-care personnel to use to get children to like spinach? Why or why not?
6. Influences on dietary behavior arising from within the person have been stated to be central to his or her food choices and dietary practices. Why is this so? Describe three of these influences in a sentence or two, and indicate why they are so important. How might understandings of these personal factors help people make dietary changes?
7. People live within social networks and may experience cultural expectations about how and what they eat. Because these can't be changed by nutrition education, why should nutrition educators be interested in such information about their intended audience?
8. Distinguish between food availability and food accessibility. How can they influence food choice? How might nutrition educators address these issues?
9. Describe four environmental factors that influence people's food choices and dietary practices. What can nutrition educators do with such information?
10. As stated earlier, in terms of healthy eating and active living, "knowledge is not enough." In your view, is that true? Why do you say so? Give evidence for your view.
11. In reviewing the competencies suggested by the Society for Nutrition Education and Behavior for a nutrition educator, which competencies do you believe that you already possess? Which ones would you like to develop further? Keep these in mind as you read the remainder of this book.

References

Academy of Nutrition and Dietetics. 2012. *ACEND Accreditation Standards for Didactic Programs in Nutrition & Dietetics*. Chicago: Academy of Nutrition and Dietetics, Accreditation Council for Education in Nutrition and Dietetics. www.eatright.org. Accessed 3/15/14.

Addessi, E., A. T. Galloway, E. Visalberghi, and L. L. Birch. 2005. Specific social influences on the acceptance of novel foods in 2–5-year-old children. *Appetite* 45(3):264–271.

Anzman-Frasca, S., J. S. Savage, M. Marini, J. O. Fisher, and L. L. Birch. 2012. Repeated exposure and associative conditioning promote preschool children's liking of vegetables. *Appetite* 58(2):543–553.

Baranowski, T., K. W. Cullen, and J. Baranowski. 1999. Psychosocial correlates of dietary intake: advancing dietary intervention. *Annual Review of Nutrition* 19:17–40.

Beauchamp, G. K. 2009. Sensory and receptor responses to umami: An overview of pioneering work. *American Journal of Clinical Nutrition* 90(3):723S–727S.

Beauchamp, G. K., and J. A. Mennella. 2009. Early flavor learning and its impact on later feeding behavior. *Journal of Pediatric Gastroenterology and Nutrition* 48(Suppl 1): S25–S30.

———. 2011. Flavor perception in human infants: Development and functional significance. *Digestion* 83(Suppl 1):1–6.

Berge, J. M., S. W. Jin, P. Hannan, D. Neumark-Sztainer. 2013. Structural and interpersonal characteristics of family meals: Associations with adolescent body mass index and dietary patterns. *Journal of the Academy of Nutrition and Dietetics* 113(6):816–822.

Birch, L. L. 1992. Children's preferences for high-fat foods. *Nutrition Reviews* 50(9):249–255.

Birch, L. L. 1999. Development of food preferences. *Annual Review of Nutrition* 19:41–62.

———. 2014. Learning to eat: Birth to two years. *American Journal of Clinical Nutrition* 99(3):723S–728S.

Birch, L. L., and S. Anzman-Frasca. 2011a. Learning to prefer the familiar in obesogenic environments. *Nestle Nutrition Workshop Series Pediatric Program*. 68:187–196.

———. 2011b. Promoting children's healthy eating in obesogenic environments: Lessons learned from the rat. *Physiology and Behavior* 104(4):641–645.

Birch, L. L., and J. A. Fisher. 1995. Appetite and eating behavior in children. *Pediatric Clinics of North America* 42(4): 931–953.

Birch, L. L., L. McPhee, B. C. Shoba, L. Steinberg, and R. Krehbiel. 1987. Clean up your plate: Effects of child feeding practices on the conditioning of meal size. *Learning and Motivation* 18:301–317.

Birch, L. L., J. S. Savage, and J. O. Fisher. 2015. Right sizing prevention: Food portion size effects on children's eating and weight. *Appetite* 88:11–16.

Blissett, J. (2011). Relationships between parenting style, feeding style and feeding practices and fruit and vegetable consumption in early childhood. *Appetite* 57(3):826–831.

Boone-Heinonen, J., P. Gordon-Larsen, C. I. K. M. Shikany, C. E. Lewis, and B. M. Popkin. 2011. Fast food restaurants and food stores longitudinal associations with diet in young to middle-aged adults: The CARDIA Study. *Archives of Internal Medicine* 171(13):1162–1170.

Bowen, D. J., M. M. Henderson, D. Iverson, E. Burrows, H. Henry, and J. Foreyt. 1994. Reducing dietary fat: Understanding the successes of the Women's Health Trial. *Cancer Prevention International* 1:21–30.

Breslin, P. A. S., and A. C. Spector. 2008. Mammalian taste perception. *Current Biology* 18(4):R148–R155.

Briefel, R. R., M. K. Crepinsek, C. Cabili, A. Wilson, and P. M. Gleason. 2009. School food environments and practices affect dietary behaviors of US public school children. *Journal of the American Dietetic Association* 109 (2 Suppl):S91–S107.

Brillat-Savarin, A. S. 1825. *The physiology of taste: Meditations on transcendental gastronomy*. Reprinted 1949. Translated by M. F. K. Fisher. New York: Heritage Press. Reprinted 2000. Washington, DC: Counterpoint Press.

Brown, R., and J. Ogden. 2004. Children's eating attitudes and behaviour: A study of the modelling and control theories of parental influence. *Health Education Research* 19:261–271.

Brug, J., K. Glanz, and G. Kok. 1997. The relationship between self-efficacy, attitudes, intake compared to others, consumption, and stages of change related to fruit and vegetables. *American Journal of Health Promotion* 12(1):25–30.

Carnell, S., L. Cooke, R. Cheng, A. Robbins, and J. Wardle. 2011. Parental feeding behaviours and motivations. A qualitative study in mothers of UK pre-schoolers. *Appetite* 57(3):665–673.

Cecil, J. E., N. A. Colin, W. Palmer, I. M. Wrieden, C. Bolton-Smith, P. Watt, et al. 2005. Energy intakes of children after preloads: Adjustment, not compensation. *American Journal of Clinical Nutrition* 82:302–308.

Chakravarthy, M. V., and F. W. Booth. 2004. Eating, exercise, and "thrifty" genotypes: Connecting the dots toward an evolutionary understanding of modern chronic diseases. *Journal of Applied Physiology* 96(1):3–10.

Chandon, P., and B. Wansink. 2007. Is obesity caused by calorie underestimation? A psychophysical model of meal size estimation. *Journal of Marketing Research* 44:84–99.

Clark, J. E. 1998. Taste and flavour: Their importance in food choice and acceptance. *Proceedings of the Nutrition Society* 57(4):639–643.

Connors, M., C. A. Bisogni, J. Sobal, and C. M. Devine. 2001. Managing values in personal food systems. *Appetite* 36(3):189–200.

Contento, I. R., S. S. Williams, J. L. Michela, and A. B. Franklin. 2006. Understanding the food choice process of adolescents in the context of family and friends. *Journal of Adolescent Health* 38(5):575–582.

Cooke, L. J., L. C. Chambers, E. V. Anez, H. A. Croker, D. Boniface, M. R. Yeomans, and J. Wardle. 2011. Eating for pleasure or profit: The effect of incentives on children's enjoyment of vegetables. *Psychological Science* 22(2):190–196.

Cooke L. J., L. C. Chambers, E. V. Anez, and L. Wardle. 2011. Facilitating or undermining? The effects of reward on food acceptance. A narrative review. *Appetite* 57(2):493–497.

Croker, H., C. Sweetman, and L. Cooke. 2009. Mothers' views on portion sizes for children. *Journal of Human Nutrition and Dietetics* 22(5):437–443.

de Castro, J. M. 2000. Eating behavior: Lessons learned from the real world of humans. *Nutrition* 16:800–813.

———. 2010. Control of food intake of free-living humans: Putting the pieces back together. *Physiology and Behavior* 100(5):446–453.

Desor, J. A., O. Mahler, and L. S. Greene. 1977. Preference for sweet in humans: Infants, children, and adults. In *Taste and the development of the genesis for the sweet preference*, edited by J. Weiffenback. Bethesda, MD: U.S. Department of Health, Education, and Welfare.

Devine, C. M., M. M. Connors, J. Sobal, and C. A. Bisogni. 2003. Sandwiching it in: Spillover of work onto food choices and family roles in low- and moderate-income urban households. *Social Science Medicine* 56(3):617–630.

Devine, C. M., M. Jastran, J. Jabs, E. Wethington, T. J. Farell, and C. A. Bisogni. 2006. "A lot of sacrifices": Work–family spillover and the food choice coping strategies of low-wage employed parents. *Social Science Medicine* 63(10):2591–2603.

Ding, D., M. A. Adams, J. F. Sallis, G. J. Norman, M. A. Hovell, C. D. Chambers et al. 2013. Perceived neighborhood environment and physical activity in 11 countries: Do associations differ by country? *International Journal of Behavioral Nutrition and Physical Activity* 10:57.

DiSantis, K. I., L. L. Birch, A. Davey, E. L. Serrano, L. Zhang, Y. Bruton, and J.O. Fisher. 2013. Plate size and children's appetite: Effects of larger dishware on self-served portions and intake. *Pediatrics* 131(5):e1451–e1458.

Dovey, T. M., P. A. Staples, E. L. Gibson, and J. C. Halford. 2008. Food neophobia and "picky/fussy" eating in children: A review. *Appetite* 50(2–3):181–193.

Drewnowski, A. 2012. The cost of U.S. foods as related to their nutritive value. *American Journal of Clinical Nutrition* 92(5):1181–1188.

Drewnowski, A., J. A. Mennella, S. L. Johnson, and F. Bellisle. 2012. Sweetness and food preference. *Journal of Nutrition* 142(6):1142S–1148S.

Duffy, V. B., and L. M. Bartoshuk. 2000. Food acceptance and genetic variation in taste. *Journal of the American Dietetic Association* 100(6):647–655.

Epictetus. *Discourses*. http://ancienthistory.about.com/od/stoicism/a/121510-Epictetus-Quotes.htm Accessed 3/10/15.

Faith, M. S., K. S. Scanlon, L. L. Birch, L. A. Francis, and B. Sherry. 2004. Parent–child feeding strategies and their relationships to child eating and weight status. *Obesity Research* 12(11):1711–1722.

Federal Trade Commission. 2012. *A review of food marketing to children and adolescents*. http://ftc.gov/os/2012/12/121221foodmarketingreport.pdf Accessed 8/14/13.

Ferreira, I., K. van der Horst, W. Wendel-Vos, S. Kremers, F. J. van Lenthe, and J. Brug. 2007. Environmental correlates

of physical activity in youth—a review and update. *Obesity Reviews* 8(2):129–154.

Feunekes, G. I., C. de Graaf, S. Meyboom, and W. A. van Staveren. 1998. Food choice and fat intake of adolescents and adults: Associations of intakes within social networks. *Preventive Medicine* 27(5 Pt 1):645–656.

Fisher, J. O. 2007. Effects of age on children's intake of large and self-selected food portions. *Obesity (Silver Spring)* 15:403–412.

Fisher, J. O., A. Arreola, L. L. Birch, B. J. Rolls. 2007. Portion size effects on daily energy intake in low-income Hispanic and African-American children and their mothers. *American Journal of Clinical Nutrition* 86(6): 1709–1716.

Fisher, J.O., and T. V. E. Kjal. 2008. Supersize me: Portion size effects on young children's eating. *Physiology & Behavior* 94(1):39–47.

Fisher, J. O., D. C. Mitchell, H. Smiciklas-Wright, and L. L. Birch. 2002. Parental influences on young girls' fruit and vegetable, micronutrient, and fat intakes. *Journal of the American Dietetic Association* 102(1):58–64.

Food Marketing Institute. 2012. *U.S. grocery shopper trends 2012. Executive summary.* Washington, DC: Author. http://www.icn-net.com/docs/12086_FMIN_Trends2012_v5.pdf Accessed 5/15/15.

———. 2013. *Supermarket Facts 2011–2012*. Washington DC: Author. http://www.fmi.org/research-resources/supermarket-facts Accessed 9/15/13.

Frankel, L. A., S. O. Hughes, T. M. O'Connor, T. G. Power, J. O. Fisher, and N. L. Hazen. 2012. Parental influences on children's self-regulation of energy intake: Insights from development literature on emotion regulation. *Journal of Obesity* 2012:327259.

Furst, T., M. Connors, C. A. Bisogni, J. Sobal, and L. W. Falk. 1996. Food choice: A conceptual model of the process. *Appetite* 26:247–266.

Gearhardt, A. N., C. M. Grilo, R. J. DiLeone, K. D. Brownell, and M. N. Potenz. 2011. Can food be addictive? Public health and policy implications. *Addiction* 106(7): 1208–1212.

Gillman, M. W., S. L. Rifas-Shiman, A. L. Frazier, et al. 2000. Family dinner and diet quality among older children and adolescents. *Archives of Family Medicine* 9(3): 235–240.

Glanz, K, M. Basil, E. Maibach and D. Snyder. 1998. Why Americans eat what they do: taste, nutrition, cost, convenience, and weight concerns as influences on food consumption. *Journal of the American Dietetic Association* 98(10):1118–1126.

Gravina, S. A., G. L. Yep, and M. Khan. 2013. Human biology of taste. *Annals of Saudi Medicine* 33(3):217–222.

Gussow, J. D. 2006. Reflections on nutritional health and the environment: The journey to sustainability. *Journal of Hunger and Environmental Nutrition* 1(1):3–25.

Hanks, A. S., D. R. Just, B. Wansink. 2013. Smarter lunchrooms can address new school lunchroom guidelines and childhood obesity. *Journal of Pediatrics* 162:867–869.

Harper, L. V., and K. M. Sanders. 1975. The effects of adults' eating on young children's acceptance of unfamiliar foods. *Journal of Experimental Child Psychology* 20:206–214.

Hearn, M. D., T. Baranowski, J. Baranowski, C. Doyle, M. Smith, L. S. Lin, et al. 1998. Environmental influences on dietary behavior among children: Availability and accessibility of fruits and vegetables enable consumption. *Journal of Health Education* 29:26–32.

Hendy, H. M., K. E. Williams, and T. S. Camise. 2005. "Kids Choice" school lunch program increases children's fruit and vegetable acceptance. *Appetite* 45(3):250–263.

Hoerr S. L., S. O. Hughes, J. O. Fisher, T. A. Nicklas, Y. Liu, and R. M. Shewchuk. 2009. Associations among parental feeding styles and children's food intake in families with limited income. *International Journal of Behavior Nutrition and Physical Activity* 13(6):55.

Horne, P. J., J. Greenhalgh, M. Erjavec, C. Fergus, S. Victor, and C. J. Whitaker. 2011. Increasing pre-school children's consumption of fruits and vegetables: A modeling and rewards intervention. *Appetite* 56:375–385.

Horne, P. J., K. Tapper, C. F. Lowe, C. A. Hardman, M. C. Jackson, and J. Woolner. 2004. Increasing children's fruit and vegetable consumption: A peer-modeling and rewards-based intervention. *European Journal of Clinical Nutrition* 58(164):1649–1660.

Hughes, S. O., T. G. Power, J. Orlet Fisher, S. Mueller, and T. A. Nicklas, 2005. Revisiting a neglected construct: Parenting styles in a child-feeding context. *Appetite* 44(1):83–92.

Hughes, S. O., R. M. Shewchuk, M. L. Baskin, T. A. Nicklas, and H. Qu. 2008. Indulgent feeding style and children's weight status in preschool. *Journal of Developmental and Behavior Pediatrics* 29(5), 403–410.

Institute of Medicine. 2006. *Food marketing to children and youth: Threat or opportunity.* Washington, DC: National Academies Press.

International Food Information Council (IFIC) Foundation. 1999. Are you listening? What consumers tell us about dietary recommendations. *Food insight: Current topics in food safety and nutrition*. Washington, DC: Author.

Israel, B. A, and K. A. Rounds. 1987. Social networks and social support: A synthesis for health educators. *Health Education and Promotion* 2:311–351.

Koch, P. A., I. R. Contento, and A. Calarese-Barton. In preparation. A qualitative analysis with 7th grade students to understand if and how the Choice, Control & Change (*C3*) curriculum develops agency in making healthy food and physical activity choices.

Konner, M. J., and S. B. Eaton. 2010. Paleolithic nutrition: Twenty-five years later. *Nutrition in Clinical Practice* 25(6):594–602.

Krebs-Smith, S. M., J. Heimendinger, B. H. Patterson, A. F. Subar, R. Kessler, and E. Pivonka. 1995. Psychosocial factors associated with fruit and vegetable consumption. *American Journal of Health Promotion* 10(2):98–104.

Ledikwe, J. H., J. Ello-Martin, C. L. Pelkman, L. L. Birch, M. L. Mannino, and B. J. Rolls. 2007. A reliable, valid questionnaire indicates that preference for dietary fat declines when following a reduced-fat diet. *Appetite* 49(1):74–83.

Lennernas, M., C. Fjellstrom, W. Becker, I. Giachetti, A. Schmidt, A. Remaut de Winter, et al. 1997. Influences on food choice perceived to be important by nationally-representative samples of adults in the European Union. *European Journal of Clinical Nutrition* 51(Suppl 2):S8–S15.

Liem, D. G., and J. A. Mennella. 2002. Sweet and sour preferences during childhood: Role of early experiences. *Development Psychobiology* 41(4):388–395.

Lipchock, S. V., J. A. Mennella, A. I. Spielman, and D. R. Reed. 2013. Human bitter perception correlates with bitter receptor messenger RNA expression in taste cells. *American Journal of Clinical Nutrition* 98:1136–1143.

Macino, L., B. H. Lin, and N. Ballenger. 2004. The role of economics in eating choices and weight outcomes. In *Agricultural Information Bulletin No 791*. Washington, DC: U.S. Department of Agriculture, Economic Research Service.

MacIntosh, W. A. 1996. *Sociologies of food and nutrition*. New York: Plenum Press.

Mathias, K. C., B. J. Rolls, L. L Birch, T. V. Krajl, E. L. Hanna, A. Davry, and J. O. Fisher. 2012. Serving larger portions of fruits and vegetables together at dinner promotes intake of both foods among young children. *Journal of the Academy of Nutrition and Dietetics* 112(2):266–270.

Mattes, R. D. 1993. Fat preference and adherence to a reduced-fat diet. *American Journal of Clinical Nutrition* 57(3):373–381.

———. 1997. The taste for salt in humans. *American Journal of Clinical Nutrition* 65(2 Suppl):692S–697S.

———. 2009. Is there a fatty acid taste? *Annual Review of Nutrition* 29:305–327.

Mennella J. A., and G. K. Beauchamp. 2005. Understanding the origin of flavor preferences. *Chemical Senses 30* Suppl 1:242–243.

Mennella, J. A., C. E. Griffin, and G. K. Beauchamp. 2004. Flavor programming during infancy. *Pediatrics* 113(4):840–845.

Mennella, J. A., C. P. Jagnow, and G. K. Beauchamp. 2001. Prenatal and postnatal flavor learning by human infants. *Pediatrics* 107(6):E88.

Morland, K., S. Wing, and A. Diez Roux. 2002. The contextual effect of the local food environment on residents' diets: The atherosclerosis risk in communities study. *American Journal of Public Health* 92(11):1761–1767.

Moss, M. 2013. *Salt, fat, sugar.* New York: Random House.

Muhammad, A., J. A. Seale, B. Meade, and B. Regmi. 2011. *International evidence on food consumption patterns (Technical Bulletin No 1929)*. Washington, DC: U.S. Department of Agriculture, Economic Research Service.

National Cancer Institute. 2007. *Health information national trends survey*. http://hints.cancer.gov/docs/HINTS2007FinalReport.pdf Accessed 5/19/15.

O'Connor, T. M., S. O. Hughes, K. B. Watson, T. Baranowski, T. A. Nicklas, J. O. Fisher, et al. 2010. Parenting practices associated with fruit and vegetable consumption in preschool children. *Public Health Nutrition* 13(1), 91–101.

Pai, H. L., and I. R. Contento. 2014. Parental perceptions, feeding practices, feeding styles, and level of acculturation of Chinese Americans in relation to their school-age child's weight status. *Appetite* 80:174–182.

Patrick, H., T. A. Nicklas, S. O. Hughes, and M. Morales 2005. The benefits of authoritative feeding style: Caregiver feeding styles and children's food consumption. *Appetite* 44:243–249.

Pelchat, M. L., and P. Pliner. 1995. "Try it. You'll like it." Effects of information on willingness to try novel foods. *Appetite* 24(2):153–165.

Peters, J. C., H. R. Wyatt, W. T. Donahoo, and J. O. Hill. 2002. From instinct to intellect: The challenge of maintaining healthy weight in the modern world. *Obesity Reviews* 3(2):69–74.

Pliner, P., M. Pelchat, and M. Grabski. 1993. Reduction of neophobia in humans by exposure to novel foods. *Appetite* 20(2):111–123.

Powell, L. M., S. Slater, D. Mirtcheva, Y. Bao, and F. J. Chaloupka. 2007. Food store availability and neighborhood characteristics in the United States. *Preventive Medicine* 44(3):189–195.

Remington, A., E. Anez, H. Croker, J. Wardle, and L. Cooke. 2012. Increasing food acceptance in the home setting: A randomized controlled trial of parent-administered taste exposure with incentives. *American Journal of Clinical Nutrition* 95:72–77.

Rhee, K. 2008. Childhood overweight and the relationship between parent behaviors, parenting style, and family functioning. *Annals of the American Academy of Political and Social Science* 615(1):11–37.

Rittenbaugh, C. 1982. Obesity as a culture-bound syndrome. *Culture and Medical Psychiatry* 6:347–361.

Robinson, J. P., and G. Godbey. 1999. *Time for life: The surprising ways Americans use their time*, 2nd ed. University Park, PA: Pennsylvania State University Press.

Robinson, T. N., M. Kiernan, D. M. Matheson, and K. F. Haydel. 2001. Is parental control over children's eating associated with childhood obesity? Results from a population-based sample of third graders. *Obesity Research* 9(5):306–312.

Rolls, B. 2000. Sensory-specific satiety and variety in the meal. In *Dimensions of the meal: The science, culture, business, and art of eating*, edited by H. L. Meiselman. Gaithersburg, MD: Aspen Publishers.

Rose, D., J. N. Bodor, C. M. Swalm, J. C. Rice, T. A Farley, and P. L. Hutchinson. 2009. Food deserts in New Orleans? Illustrations of urban food access and implications for policy. Presented at *Understanding the Economic Concepts*

and Characteristics of Food Access. USDA, Washington, DC. January 23, 2009. University of Michigan National Poverty Center/USDA Economic Research Service. http://www.npc.umich.edu/news/events/food-access/index.php Accessed 10/1/10.

Rosland, A. M., E. Kieffer, B. Israel, M. Cofield, G. Palmisano, et al. 2008. When is social support important? The association of family support and professional support with specific diabetes self-management behaviors. *Journal of General Internal Medicine* 23(12):1992–1999.

Rozin, P. 1988. Social learning about food by humans. In *Social learning: Psychological and biological perspectives*, edited by T. R. Zengall and G. G. Bennett. Hillsdale, NJ: Lawrence Erlbaum.

———. 1996. Sociocultural influences on human food selection. In *Why we eat what we eat: The psychology of eating*, edited by E. D. Capaldi. Washington, DC: American Psychological Association.

Rozin, P., and A. E. Fallon. 1987. A perspective on disgust. *Psychology Review* 1:23–41.

Sallis, J. F., and K. Glanz. 2009. Physical activity and food environments: Solutions to the obesity epidemic. *Milbank Quarterly* 87(1):123–154.

Salvy, J. S., M. Howard, M. Read, and E. Mele, 2009. The presence of friends increases food intake in youth, *American Journal of Clinical Nutrition* 90(2):282–287.

Satia-Abouta, J., R. E. Patterson, M. L. Neuhouser, and J. Elder, 2002. Dietary acculturation: Applications to nutrition research and dietetics. *Journal of the American Dietetic Association* 102(8):1105–1118.

Satter, E. 2000. *Child of mine: Feeding with love and good sense*. 3rd ed. Boulder, CO: Bull Publishing.

Savage, J. S., J. O. Fisher, and L. L. Birch. 2007. Parental influence on eating behavior: Conception to adolescence. *Journal of Law and Medical Ethics* 35(1):22–34.

Savage, J. S., I. H. Halsfield, J. O. Fisher, M. Marini, and L. L. Birch. 2012. Do children eat less at meals when allowed to serve themselves? *American Journal of Clinical Nutrition* 96(1):36–43.

Sclafani, A., and K. Ackroff. 2004. The relationship between food reward and satiation revisited. *Physiology and Behavior* 82(1):89–95.

Shepherd, R. 1999. Social determinants of food choice. *Proceedings of the Nutrition Society* 58(4):807–812.

Skinner, J. D., B. R. Carruth, B. Wendy, and P. J. Ziegler. 2002. Children's food preferences: A longitudinal analysis. *Journal of the American Dietetic Association* 102(11):1638–1647.

Small, D. M., and J. Prescott. 2005. Odor/taste integration and the perception of flavor. *Experimental Brain Research* 166(3–4):345–357.

Sobo, E. 1997. The sweetness of fat: Health, procreation, and sociability in rural Jamaica. In *Food and culture: A reader*, edited by C. Counihan and P. Van Esterik. New York: Routledge, pp. 251–255.

Society for Nutrition Education. 1987. Recommendations for the Society for Nutrition Education on the academic preparation of nutrition education specialists. *Journal of Nutrition Education* 19(5):209–210.

Society for Nutrition Education and Behavior. 2015. Competencies for nutrition educators. SNEB.org. Accessed 4/27/15.

Spill, M. K., L. L. Birch, L. S. Roe, and B. J. Rolls. 2010. Eating vegetables first: The use of portion size to increase vegetable intake in preschool children. *American Journal of Clinical Nutrition* 91(5):1237–1243.

———. 2011. Serving large portions of vegetable soup at the start of a meal affected children's energy and vegetable intake. *Appetite* 57(1):213–219.

Story, M., and S. French. 2004. Food advertising and marketing directed at children and adolescents in the US. *International Journal of Behavioral Nutrition and Physical Activity* 1(1):3.

Stunkard, A. 1975. Satiety is a conditioned reflex. *Psychosomatic Medicine* 37(5):383–387.

Supermarket News. June 3, 2013. Study shows shoppers' digital, health trends. http://supermarketnews.com/datasheet/june-3-2013-study-shows-shoppers-digital-health-trends Accessed 5/7/15.

Tepper, B. J. 2008. Nutritional implications of genetic taste variation: The role of PROP sensitivity and other taste phenotypes. *Annual Review of Nutrition* 28:367–388.

Thompson, D. 2013. In America, food is getting cheaper—unless you're poor. *The Atlantic*. http://www.theatlanticcities.com/politics/2013/03/america-food-getting-cheaper-unless-youre-poor/4923/ Accessed 11/3/14.

Trabulsi, J. C., and J. A. Mennella. 2012. Diet, sensitive periods in flavor learning, and growth. *International Review of Psychiatry* 24:219–230.

Tucker R. M., Mattes R. D., Running CA. 2014 Mechanisms and effects of "fat taste" in humans. *Biofactors* 40(3): 313–326.

U.S. Department of Agriculture, 2012a. *Food Environment Atlas*. Washington, DC: USDA, Economic Research Service. http://www.ers.usda.gov/data-products/food-environment-atlas.aspx Accessed 9/15/13.

———. 2012b. *Food Expenditures*. Washington, DC: USDA Economic Research Service. http://www.ers.usda.gov/data-products/food-expenditures.aspx#26654 Accessed 1/15/14.

———. 2013. *Food security status of United States Households, 2012*. Washington, DC: USDA, Economic Research Service, http://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/key-statistics-graphics.aspx. Accessed 5/19/15.

U.S. Department of Labor, 2013a. *American time use statistics, 2013*. Washington, DC: United States Department of Labor, Bureau of Labor Statistics, http://www.bls.gov/tus/ Accessed 5/19/15.

U.S. Department of Labor, 2013b. *Consumer Expenditure Survey*, Washington, DC: U.S. Department of Labor, Bureau of Labor Statistics. http://www.bls.gov/cex/ Accessed 5/19/15.

Van der Horst, K., S. Kremers, I. Ferreira, A. Singh, A. Oenema and J. Brug. 2007. Perceived parenting style and practices and the consumption of sugar-sweetened beverages by adolescents. *Health Education Research* 22(2) 295–304.

Ventura, A. K., and L. L. Birch. 2008. Does parenting affect children's eating and weight status? *International Journal of Behavioral Nutrition and Physical Activity* 5:15.

Ver Ploeg, M., V. Breneman, T. Farrigan, K. Hamrick, D. Hopkins, P. Kaufman, et al. 2009. Access to affordable and nutritious food—measuring and understanding food deserts and their consequences. *Report to Congress. United States Department of Agriculture,* Administrative Publication No. (AP-036).

Wansink B., D. R. Just, C. R. Payne, and M. Z. Klinger. 2012. Attractive names sustain increased vegetable intake in schools. *Preventive Medicine* 55(4):330–332.

Wardle, J., L. L. Cooke, E. L. Gibson, M. Sapochnik, A. Sheiham, and M. Lawson. 2003. Increasing children's acceptance of vegetables; a randomized trial of parent-led exposure. *Appetite* 40(15), 155–162.

Washington State Magazine. 2013. Annual income spent on food. [map]. Washington State University. http://wsm.wsu.edu/researcher/WSMaug11_billions.pdf Accessed 8/15/13.

Wendel-Vos, W., M. Droomers, S. Kremers, J. Brug, and F. van Lenthe. 2007. Potential environmental determinants of physical activity in adults: A systematic review. *Obesity Reviews* 8(5):425–440.

World Health Organization. 2013. *Marketing of food high in fat, salt and sugar to children: update 2012–2013.* Copenhagen, Denmark: WHO Regional Office for Europe.