CHAPTER

2

Overview of 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 and their implications for nutrition education. It also provides a description of the desired competencies outlined by professional nutrition societies for nutrition educators.

CHAPTER OUTLINE

- Introduction
- Determinants of food choice and dietary behavior
- Food-related determinants
- Person-related determinants
- Social and environmental determinants
- Economic determinants
- Information environment
- Implications for nutrition education
- Implications for competencies and skills for nutrition educators
- Summary

LEARNING OBJECTIVES

At the end of the chapter, you will 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 nutrition educators
- State the competencies needed to be an effective nutrition educator

INTRODUCTION: KNOWLEDGE IS NOT ENOUGH

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 often is 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, nutrition educators believe that their task is to provide the public with information to eat well. They plan sessions on MyPyramid and food label reading. They provide lists of high-fat or high-fiber foods, or food sources of nutrients such as calcium or vitamins. They discuss

managing food budgets. However, studies show that simply providing this kind of knowledge is not enough. People often know to eat well but do not—just like Alicia and Ray.

A survey by a consumer research group has found that whereas about one quarter of the public consider nutrition to be very important and are very careful about what they eat, the rest fall almost equally into two groups that either don't want to be bothered or that know what they ought to do but will not or cannot do it (Balzer 1997). A U.S. Department of Agriculture (USDA) analysis found that 40% of the people surveyed said their diet needed no improvement. Of the remaining 60%, 23% were interested in improving their diet, whereas 37% were not (U.S. Department of Agriculture 2000). Similarly, another 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). Clearly, then, 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 their food choices and diet-related behaviors.

This is not to say that knowledge is not important: knowledge in some form is a prerequisite for intentional healthful eating. However, food is more than nutrients, and eating is about more than health. Eating is a source of pleasure and is related to many of life's social functions. Eating behaviors are acquired over a lifetime, and changing them requires alterations in these behaviors for the long term—indeed, permanently. Unlike other health-related behaviors such as smoking, eating is not optional. People have to eat, and any changes they make are undertaken with a great deal of ambivalence. They want to eat to satisfy physical hunger and psychological desires and yet want to be healthy, which may require adopting eating patterns that conflict with these desires.

Nutrition education ultimately has to be about food and eating. Understanding people, their behavior, and the context of their behavior is one of the keys to effective nutrition education programs. Thus, it is very important for nutrition educators to understand the various forces that influence an individual's or a community's decision to eat in a particular way. This chapter provides a brief overview of the factors influencing food choice and dietary behaviors for the purpose of helping nutrition educators design more effective nutrition education programs.

DETERMINANTS OF FOOD CHOICE AND DIET-RELATED BEHAVIOR: AN OVERVIEW

People 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, 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 the ability of people to act on their biological predispositions, preferences, or personal imperatives. The influences are so numerous as to be overwhelming to try to understand! This chapter simplifies matters by examining these influences in three categories that are commonly used in studying food choice: 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).

The number of influences on our diet choices is endless.

Many factors within each of these categories influence our eating. These influences are explored in greater detail in the following sections.

FOOD-RELATED DETERMINANTS: BIOLOGY AND EXPERIENCE

When asked, most people say their food choices are largely determined by "taste" (Glanz et al. 1998; Clark 1998; Food Marketing Institute 2002). By *taste*, they mean *flavor*, which includes smell and the oral perception of food texture as well (Small & Prescott 2005). Sensory-affective responses to the taste, smell, sight, and texture of food are a major influence on food preferences and food choices. What are people born with and what is learned?

Biologically Determined Behavioral Predispositions

The Basic Tastes

Humans are born with unlearned biological predispositions toward liking the sweet taste and rejecting sour and bitter tastes (Desor, Mahler, & Greene 1977; Mennella & Beauchamp 1996). The liking for the sweet taste remains throughout life and appears to be universal to all cultures (Pepino & Mennella 2005). The liking for salt seems to develop several months after birth, when infants have matured somewhat (Bernstein 1990). 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 (**Box 2-1**).

Preference for fat appears early in infancy or childhood. Fat is less a flavor than a contributor to texture (Mattes 2009). 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.

A fifth taste has been identified: *umami*, a Japanese word for deliciousness, which is associated with the brothiness of soup or the meati-

Box 2-1 Meditation on Taste: A Nineteenth-Century Viewpoint

Taste, such as Nature has given to us, is yet one of our senses (among others such as hearing and sight) that, all things considered, procures to us the greatest of enjoyments:

1. Because the pleasure of eating is the only one that, taken in moderation, is never followed by fatigue.
2. Because it belongs to all times, all ages, and all conditions.
3. Because it occurs necessarily at least once a day, and may be repeated without inconvenience two or three times in this space of time.
4. Because it can be combined with all our other pleasures, and even console us for their absence.
5. Because the impressions it receives are at the same time more durable and more dependent on our will.
6. Finally, because in eating we receive a certain indefinable and special comfort, which arises from the intuitive consciousness that we repair our losses and prolong our existence by the food we eat.

Source: 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.

ness in mushrooms. It seems to be related to glutamate, an amino acid, and captures what is described as the taste of protein in food (de Araujo et al. 2003). 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 (Mela & Mattes 1988).

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. These individuals differ in the number of fungiform taste buds they have, with supertasters having the most taste buds and nontasters the least (Tepper & Nurse 1997). Such differences between individuals may be related to differences in being able to discriminate between different foods and may result in differences in liking for certain foods, such as some bitter vegetables, alcohol, citrus fruit, and fatty or sugary foods (Tepper & Nurse 1997; Duffy & Bartoshuk 2000; Kaminski, Henderson, & Drewnowski 2000). It has been suggested that such differences in responses to food may be related to food intake patterns and body weight variation (Tepper 1998, 2008; Keller & Tepper 2004).

Hunger and Satiety

Many genetic and biological mechanisms control hunger and satiety, ensuring that people will eat enough to meet their energy needs (de Castro 1999). 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 (Neel 1962; Eaton, Eaton, & Konner 1997; Lowe 2003; Chakravarthy & Booth 2004). Today's environment, however, is one in which food is widely available, inexpensive, and often high in energy density, while minimal physical activity is required for daily living. Researchers have proposed that the "modern environment has taken body weight control from an instinctual (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.

Sensory-Specific Satiety

Humans also appear to have a built-in biologically determined sensory-specific satiety mechanism whereby they get tired of one taste and move on to another one over a short time span, such as while eating a meal (Rolls 2000). Such a mechanism probably had adaptive value for humans because it ensures that people eat a variety of different-tasting foods and thus obtain 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 of scarce food supply. However, in today's food environment, the variety possible in meals because of the wide array of foods available may contribute to overweight.

These biologically determined predispositions contribute to some degree to preference and to food intake, particularly in children, and are shown in **Figure 2-1**. However, as you shall see in the next section,

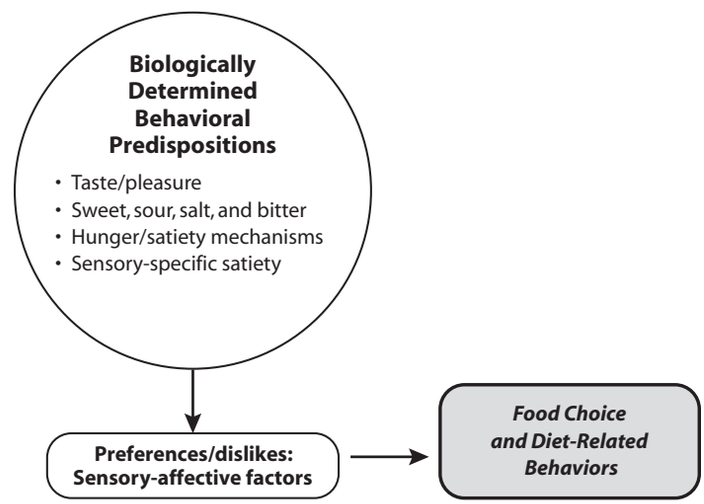


FIGURE 2-1 Our biologically determined behavioral predispositions that influence food choices and dietary behaviors.

most preferences are 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 food acceptance patterns are largely learned (Birch 1999; Mennella, Griffin, & Beauchamp 2004; Mennella & Beauchamp 2005; Beauchamp & 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 from repeated exposure to a food.

Pre- and Postnatal Experience

Such learning begins early, possibly even prenatally. Flavors such as garlic and alcohol have been detected in mothers' milk, possibly familiarizing infants with these flavors (Beauchamp & Mennella 2009). In one study, breastfed infants whose mothers were fed carrot juice during pregnancy or during lactation showed increased acceptance of carrot flavor in their cereal at weaning (Mennella, Jagnow, & 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 et al. 2004). Infants fed hydrosylate liked sour tastes into early childhood (Liem & Mennella 2002).

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 individuals 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 a person's life, but early experience with food and eating is especially crucial in the development of eating patterns, in terms of both the kinds of food the person comes to like and the amount he or she eats. 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": they need to seek variety in their 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). This would have adaptive value because infants are fed by adults, but 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 12 to 15 exposures (Birch & Marlin 1982; Birch 1998, 1999), probably through a "learned safety mechanism." That is, when eating a food is not followed by negative consequences, 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 (Birch, McPhee, Shoba, Pirok et al. 1987). Picky or fussy eating is somewhat different—it is the rejection of a large proportion of familiar (as well as 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.

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.

Experience and the Basic Tastes

Biologically determined behavioral propensities can be modified by experience in adults as well (Pliner, Pelchat, & Grabski 1993; Pelchat & Pliner 1995). For example, those who eat lower-salt diets come to like them more (Beauchamp, Bertino, & Engelman 1983; Mattes 1997). The dislike for bitterness can be overcome, as shown by the infant study described earlier 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 (Johnson, McPhee, & Birch 1991; Birch & Fisher 1995). The ability to learn about how full familiar foods can make you feel may explain how meals can be terminated before people have yet experienced the physiological cues that signal satiety. Thus, as a result of repeatedly consuming familiar foods, people learn about 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).

Our Preference for Calorie-Dense Foods

Humans seem to prefer calorie-dense foods over calorie-dilute versions of the same foods (Birch, McPhee, Shoba, Steinberg et al. 1987; Birch 1992). The biological mechanism that assists people 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 & Ackroff 2004) 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 social-affective environment 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 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 & Sanders 1975; Addessi et al. 2005). Food preferences also increase when adults offer the foods in a friendly way (Birch 1999).

Parenting Practices

Parenting practices related to food are strategies used to provide for the nourishment of children. The practices of parents, family, and other caregivers can encourage healthful eating or modify and interfere with the child's ability to respond to food appropriately. 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. For example, children who are led to pay attention to their internal cues (feelings of hunger and being full) are more likely to be able to eat the appropriate amount of food than are those who are asked to focus on externally oriented cues such as the time of day or the amount of food remaining on the plate (Birch, McPhee, Shoba, Steinberg et al. 1987; Birch 1999). Children at age 3 eat about the same amount regardless of the portion size of the food offered. However, by age 5, children eat more when they are offered more (Rolls, Engell, & Birch 2000).

Rewards

The use of rewards has complex consequences (Birch 1999; Savage, Fisher, & Birch 2007; Ventura & Birch 2008). If a food is given as a reward, there is a significant *increase* in preference: "You did a good job cleaning up the toys. Here, have some peanuts." The opposite is true if the child is asked to eat a food to obtain a reward: "If you eat your spinach, you can watch TV." In particular, requiring eating of a less-liked food to obtain a better-liked food ("You can have dessert if you eat your spinach") can *decrease* even further the liking for the initially less-liked food because children reason (as do adults) that the food must taste bad if they have to be bribed to eat it. In addition, because the foods used as rewards are typically those high in sugar, fat, and salt (e.g., desserts and salty snacks), such a practice may enhance even further the preference for these items.

The Way Parents Offer Foods

Pressure to eat has been associated with lower levels of children's intake and weight and higher levels of pickiness. It could be the other way around also: that parents of picky eaters and thin children may apply pressure to eat (Ventura & Birch 2008). *Excessive restriction* of foods can make the restricted foods more attractive. Thus, highly restrictive parental controls limit the opportunities for children to practice self-regulation and maintain a healthy weight (Birch, Fisher, & Davison 2003; Faith et al. 2004). This can also result in overeating in the absence of hunger when given free access to an array of tasty snacks (Birch et al. 2003). However, in some populations, mothers' own flexible restraint can result in more healthful food choices for themselves and their children (Robinson et al. 2001; Contento, Zybert, & Williams 2005), this control being interpreted as expressing parental responsibility and caring (Lin & Liang 2005). At the same time, parents' own practices in terms of eating more fruits and vegetables highly influence what their daughters eat (Fisher et al. 2002). It has been concluded that the best practice is for adults to offer an array of *healthful* foods and for children to choose which of them to eat (Satter 2000). Thus, the practices of parents, child-care centers, and nutrition educators who work with young children can have important influences on the children's body weight and eating habits (Birch & Fisher 2000). Many of these same findings apply to adults as well and can inform the work of nutrition educators (Pliner et al. 1993).

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 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.

Food preferences have a very direct impact on children's intakes because children tend to eat the foods they like and reject the foods they do not like in terms of taste, smell, or texture. The relationship between taste preferences and food choices is more indirect in older children and adults because experience with food and beliefs about the impact of food on weight, appearance, health, or other valued outcomes can modify their propensity to act on their preferences for high-fat and high-sugar foods. These considerations may lead individuals to eat more healthful diets even if these are not the most appealing, as we discuss in the next section.

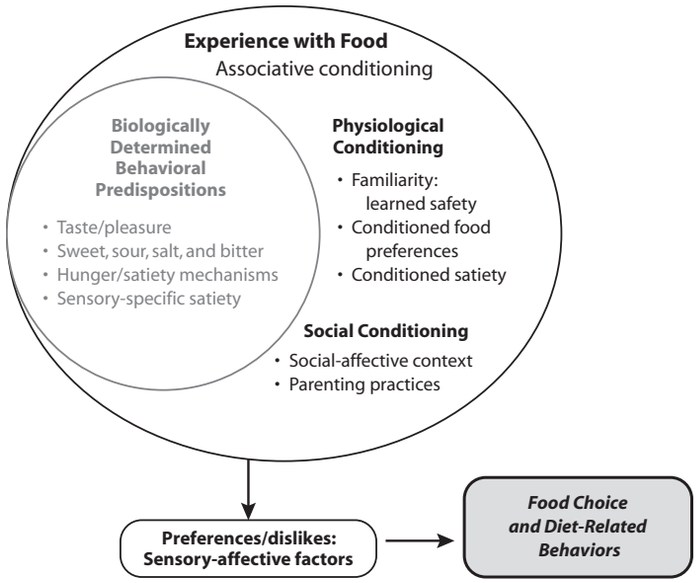


FIGURE 2-2 Our experiences with food that influence food choices and dietary behaviors.

PERSON-RELATED DETERMINANTS

Biology and personal experiences with food are not the only influences on individuals' food intake. People 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 people's interactions with others in their social environment. These influences or determinants are shown in **Figure 2-3**.

Intrapersonal Determinants

Perceptions, Beliefs, Attitudes, and Motivations

Our food choices and dietary practices are 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 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). In Europe, the major values are quality/freshness, price, nutritional value, and family preferences, in that order (Lennernas et al. 1997).

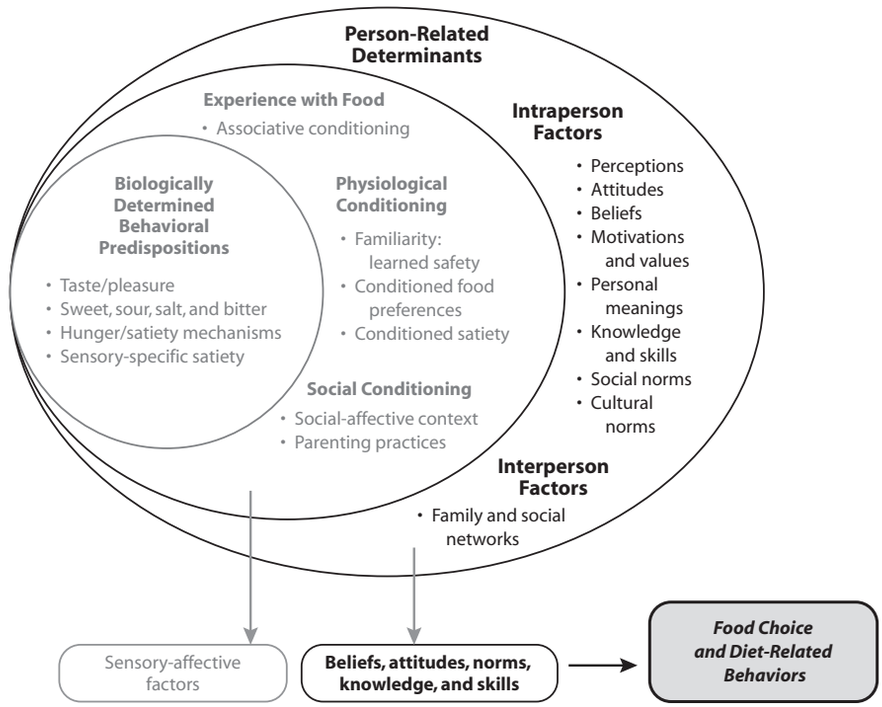


FIGURE 2-3 Intra- and interpersonal factors that influence food choices and dietary behaviors.

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.

The Process of Choosing Foods

Environmental Stimuli

Our thoughts and feelings interact with what we experience in the environment. For example, we you 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 criteria or reasons for food choice, such as 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). Or 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

People's food-related knowledge and skills also influence what they eat. In particular, their misconceptions may play an important role. 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 one, and another third thought it was two; only 8% thought it was five (Krebs-Smith et al. 1995). Many consumers have major misconceptions about the amounts of fat and energy in many common foods and in their own diets (Mertz et al. 1991; Mela 1993; Brug, Glanz, & Kok 1997). Lack of skills in preparing foods also influences what individuals eat.

Social and Cultural Norms

Humans are social creatures. We all live in a social and cultural context and experience 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 breast-feed may be influenced very much by the desires of a woman's family. 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. 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% to 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. 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. She also must consider whether she has the space in the refrigerator to keep both types of milk, which then becomes a barrier to change.

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 & Glanz 2009).

Food Availability and Accessibility

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 50,000 food items are available in U.S. supermarkets, and about 9,000 new brand-name processed food products are introduced each year (Gallo 1998; Lipton, Edmondson, & Manchester 1998). The typical shopper averages 2.2 trips to the supermarket each week (Food Marketing Institute 2005). 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.

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 the homes, which in turn is related to a higher quality of food choices and intakes (Cheadle et al. 1991; Morland, Wing, & Diez Roux 2002). 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). A study of data from 28,050 zip codes and the 2000 census found that low-income neighborhoods had only 75% as many chain supermarkets as middle-class neighborhoods and that African American neighborhoods had only 52% and Hispanic neighborhoods 32% as many chain supermarkets as in white neighborhoods (Powell et al. 2007). There is now discussion of "food deserts" in neighborhoods.

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 in them 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. The National School Lunch Program provides meals that conform to federal guidelines that specify nutritional standards to be met. Increasingly, however, à la carte offerings, vending machines, and school stores compete for student participation; the foods available from these sources are not subject to these guidelines. Participation in the School Lunch Program declines with age so that by high school two thirds of students are obtaining 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. 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 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 the counter ready to eat. The limited accessibility of healthful, convenient foods in many settings may narrow good choices and make it difficult to eat healthfully.

Built Environment and Physical Activity

The role of environmental determinants of physical activity has also been studied. The walk-ability 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 Structures 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 1995, 2000). 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 that of their children (Fisher et al. 2002; Contento et al. 2005), 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).

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

Families who eat together generally have better-quality diets.

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, and these traditions influence eating patterns.

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 and cultural traditions, individuals wanting 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 must 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 DETERMINANTS

Many factors in the economic environment influence food choices and dietary practices, among them 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, resulting in part from 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 one to two 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 & Barrett-Fornell 2004). When freely chosen diets were studied, it was found that adding fats and sweets was associated with a 5% to 40% decrease in overall food costs, whereas adding fruits and vegetables was associated with a 20% to 30% increase in overall food costs (Drewnowski, Darmon, & Briend 2004). 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.

Income

People in the United States spend only about 10% of their disposable income on food prepared and consumed at home, compared with 15% in Europe and Japan, 35% in middle-income countries, and 53% in low-income countries (Seale, Regmi, & Bernstein 2003). However, this is an average. The amount of money spent on food depends on income level. 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 more discounted items and generic brands and thus spend less on food; despite this, food accounts for 20% to 35% of their income (Putnam & Allhouse 1999). 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, & Ballenger 2004).

In this context, statistics show that about 11% to 12% of American households are *food insecure*, meaning that they do not have access, at all times, to enough food for an active, healthy life for all household members. The prevalence of food insecurity with hunger is about 3% to 4%, hunger being defined as the uneasy or painful sensation caused by lack of food (Food Research and Action Council 2005).

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 & Godbey 1999; National Pork Producers Council 2002; Cutler & Glaeser 2003).

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 are better able to attend to their own health (Macino et al. 2004). Nutrition educators need to consider these time constraints in the development of nutrition education interventions.

Education

In general, more highly educated individuals eat a higher-quality diet and are less sedentary partly because of watching less TV (Macino et al. 2004). People with more education may be better able to obtain,

Consumers are inundated with food choices at the supermarket.

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).

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 (Food Marketing Institute 2002).

INFORMATION ENVIRONMENT

Knowing the information context of the audience is important for nutrition educators to design messages and programs that are appropriate.

Media

The current media-saturated environment has undergone revolutionary changes in the past two 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 ages 2 to 4 years are exposed to about 4 hours a day of various media. This increases to 8 hours a 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 a week as music becomes more important. Adults spend about 15 to 17 hours a 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.

Advertising

The media have demonstrated a powerful capacity to persuade and the U.S. food system is the economy's largest advertiser (Gallo 1995). The food industry spends about $26 billion per year on marketing and advertising (Elitzak 2001), with $15 billion aimed at children. Most of this is spent by companies that produce high-fat and/or high-sugar products that are highly processed and packaged; examples include $150 million for candy bars, $580 million for soft drinks, and more than $1.5 billion for fast foods (Center for Science in the Public Interest 2003). 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 (Taras et al. 2000; Borzekowski & Robinson 2001; Story & French 2004; Institutes of Medicine 2006). In addition, federally sponsored promotions of commodities such as milk, cheese, grapefruit juice, and orange juice resulted in greater sales (Gallo 1996). Just for comparison, the National Cancer Institute's budget for its program to promote fruit and vegetable intake is about $4 million. The ubiquity of advertising, together with the amount of time people spend watching television and are exposed to marketing, makes these influences considerable. The environmental influences on food choice and dietary behavior are summarized in **Figure 2-4**.

IMPLICATIONS FOR NUTRITION EDUCATION

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, but they are all related, each larger circle encompassing the influences of the smaller circles. These concentric circles reflect levels of influence or overlapping spheres of influence.

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. Similarly, interventions to decrease the intake of food components such as fat or salt should

NUTRITION EDUCATION IN ACTION 2-1

Multiple Influences on Breastfeeding: A Study of Low-Income Mothers

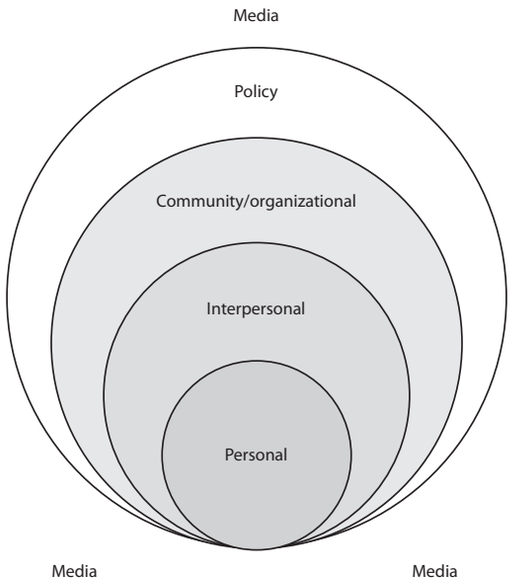
Media influences: TV shows and print media foster the perception that formula feeding is the norm whereas breastfeeding is not. Instead, women's breasts are used to advertise lingerie, perfume, or alcohol: these images influence personal beliefs.

Policy influences: There is legislation that supports breastfeeding in the work setting. Legislation also requires low-income mothers to work, 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.



Source: 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.

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).

The use of foods in positive contexts as rewards or treats enhances liking for those foods, whereas having people eat a food to obtain a reward likely produces a decline in liking for that food. Because foods high in fat, sugar, and salt are widely available, particularly in positive social-affective contexts such as celebrations, nutrition educators need to help people recognize the impact of such social environmental forces on their eating patterns and acquire the competencies to address them.

Although these mechanisms influence eating behaviors directly, they also exert their influence through psychological processes that can be perhaps even more powerful. Individuals develop attitudes toward foods, values, beliefs, and personal meanings, and these intra- and interpersonal determinants also influence food choices and eating patterns.

Addressing Environmental Determinants and Personal Perception

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, 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 is 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. Nutrition educators need to learn about the sacrifices individuals are willing to make to engage in

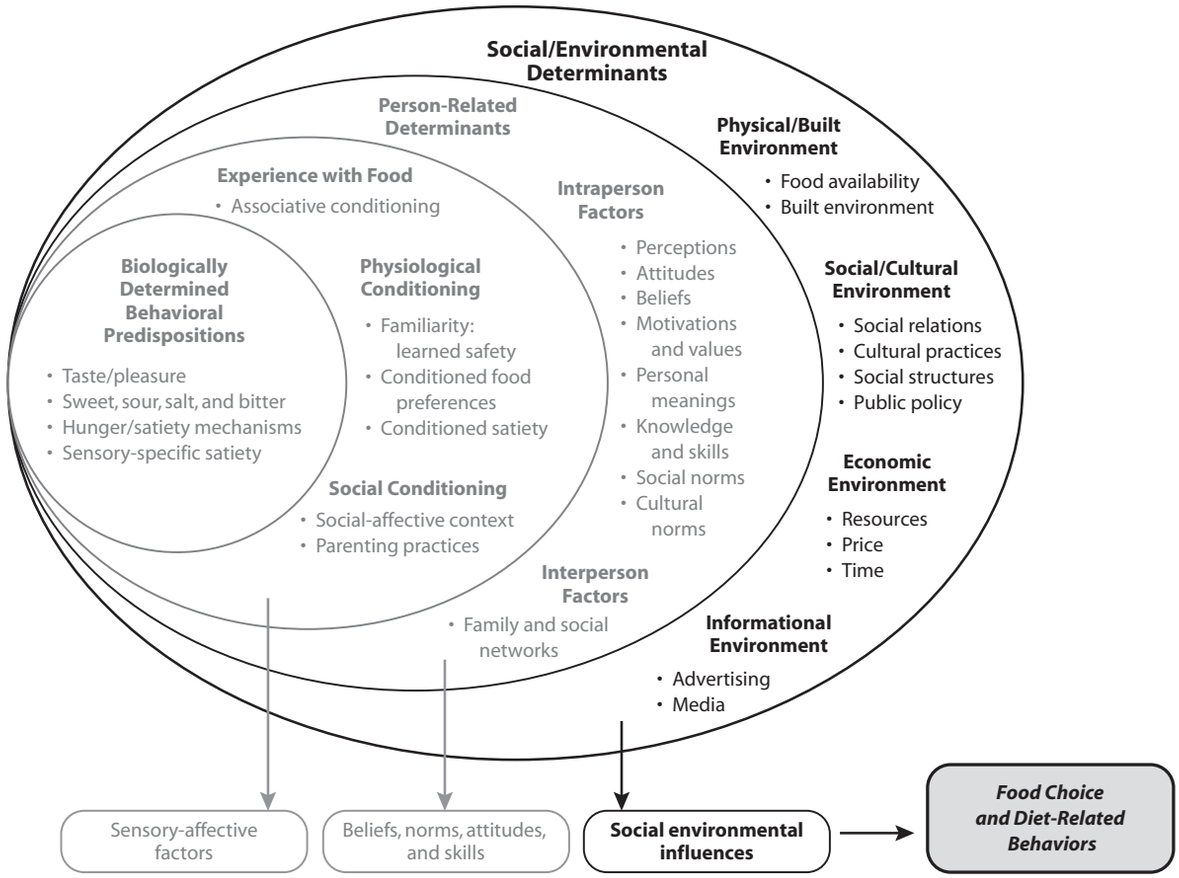


FIGURE 2-4 Social and environmental factors that influence food choices and dietary behaviors.

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 became more complex. There are about 50,000 items in a supermarket and about 9,000 new food items introduced each year that people must learn about. No longer do people choose from three or four types of cold breakfast cereal, but from whole supermarket aisles 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.

The Importance of Personal Perception

The point that is important for nutrition educators to understand is that although food-related factors and environmental context have significant independent influences on diet, they also influence the development of beliefs, attitudes, interpretations, feelings, and meanings, which in turn influence behavior. It becomes clear, then, that perceptions, attitudes, beliefs, and meanings 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. 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. How these determinants of food choice and dietary behaviors can be effectively addressed through nutrition education activities is described in the remaining chapters in this book.

NUTRITION EDUCATION IN ACTION 2-2

Programs to Accommodate 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 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.

Operation Frontline

Share Our Strength's Operation Frontline is a nationwide nutrition education program developed to address the root causes of hunger in the United States. Operation Frontline enables chefs, nutritionists, and dieticians to share their strengths by teaching interactive 6-week classes on nutrition and food budgeting to adults and children who are at risk of hunger. Operation Frontline classes make a concrete difference in the lives of program participants. The impact may be as basic as learning how to get a child to eat vegetables or how to cut up a chicken, or can be as profound as providing a starting point for a career in the culinary industry. One special feature is that after each class, each participant receives a bag of groceries containing all the ingredients needed to make that class's meal at home. Class participants then report to the instructors during the next class session on their success with making a meal at home and their families' reactions. Since its inception in 1993, more than 31,000 people have participated in Operation Frontline classes and an additional 89,000 have received nutrition information through nutrition fairs and events.

Sources: Magnus, M. H. 2004. Barbershop nutrition education. *Journal of Nutrition Education and Behavior* 36:45–46; Benepe, C. 2003. People at work: 5-a-Day tailgate sessions. Presentation, Annual Meeting of the Society for Nutrition Education, July 26, Philadelphia, PA; and Share Our Strength. n.d. What we do. http://www.strength.org/what/operationfrontline.

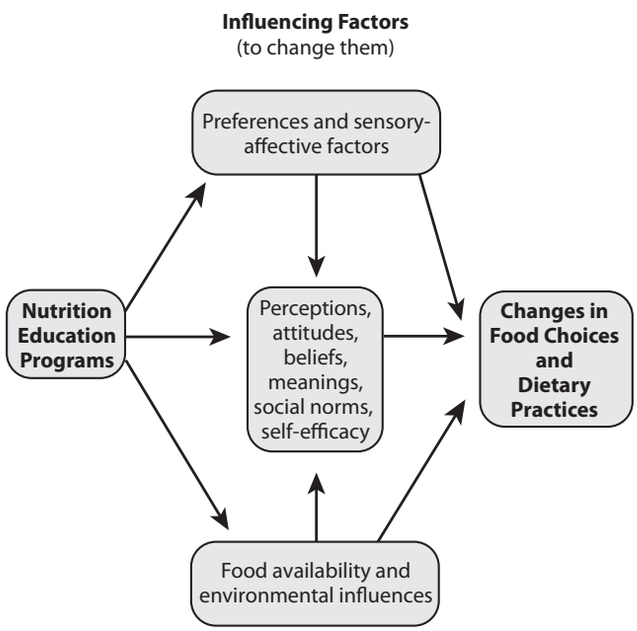


FIGURE 2-5 The process of nutrition education.

IMPLICATIONS FOR COMPETENCIES AND SKILLS FOR NUTRITION EDUCATORS

Nutritionists and dietitians are well grounded in nutrition science and clinical nutrition 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. One approach might be for nutrition educators to deliver nutrition education through the use of teams, in which nutritionists focus only on providing the nutrition science content and behavioral specialists actually design and deliver the educational sessions. However, that is neither practical nor desirable. 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.

The Society for Nutrition Education's Competencies for Nutrition Education Specialists

The Society for Nutrition Education (SNE) has adopted a list of the competencies that nutrition education specialists should have (Society for Nutrition Education 1987). The society believes that nutrition education specialists should be competent in the following five areas:

1. *Food and nutrition content:* Understanding the fundamentals of nutrition science, food science, and clinical nutrition; having the ability to accurately assess nutritional status of individuals and groups; applying appropriate dietary guidelines in making dietary recommendations
2. *Eating behavior:* Understanding the complexities of food supply systems and their effects on food selection; understanding the physiological, psychological, and environmental (social, cultural, and economic) determinants of eating behavior
3. *Behavioral and educational theory:* Ability to apply learning theory, instructional theory, and behavior change theories in nutrition education; in particular, use of theories and techniques from the behavioral sciences for modifying food behavior
4. *Research methods and program evaluation:* Ability to analyze and evaluate both popular and scientific literature, and to use appropriate designs and methods to conduct research and program evaluations in nutrition education
5. *Design and delivery of nutrition education:* Designing nutrition education programs, curricula, and materials; delivering nutrition education programs, including the ability to communicate with individuals, small groups, organizations, and mass audiences, to write clearly, and to use supplemental materials appropriately; implementing and administering nutrition education programs

American Dietetic Association's Competencies

The American Dietetic Association's standards for the education of entry-level dietitians (American Dietetic Association 2002) include some competencies that are relevant for nutrition education as well:

1. *Communications:* Graduates will have *knowledge of* negotiation techniques, lay and technical writing, media presentations, interpersonal communication skills, counseling theory and methods, interviewing techniques, educational theory and techniques, concepts of human and group dynamics, public speaking, and educational materials development. Also, graduates will have *demonstrated the ability* to use oral and written communications in presenting an educational session for a group, counsel individuals on nutrition, document appropriately a variety of activities, explain a public policy position regarding dietetics, use current information technologies, and work effectively as a team member.
2. *Social sciences:* Graduates will have *knowledge of* public policy development, psychology, and the health behaviors and educational needs of diverse populations.
3. *Nutrition:* Graduates will have *knowledge of* health promotion and disease prevention theories and guidelines.

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 and salt tastes and umami 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.

Person-Related Determinants

People acquire knowledge and 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. Families and social networks also influence food choices.

Social/Environmental Determinants

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

Knowledge Is Not Enough

Consequently, knowledge is not enough for people to eat healthfully and live actively. Nutrition education must address all these determinants of behavior if it is to be effective.

Consequences for the Skills of Nutrition Educators

These considerations make it clear that nutrition educators need a set of skills in addition to their knowledge of food and nutrition. We need to develop the skills to understand people, their behavior, and the context of their behavior.

Questions and Activities

1. 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?
2. 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?
3. How can nutrition educators help young children learn to self-regulate the amount of food they eat?
4. "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?
5. 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?
6. 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?
7. Distinguish between food availability and food accessibility. How can they influence food choice? How might nutrition educators address these issues?
8. Describe four environmental factors that influence people's food choices and dietary practices. What can nutrition educators do with such information?
9. 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?
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 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

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.

American Dietetic Association. 2002. *CADE accreditation handbook*. Chicago: American Dietetic Association, Commission on Accreditation for Dietetics Education.

Balzer, H. 1997. *The NPD Group's 11th annual report on eating patterns in America: National eating trends tracking*. Port Washington, NY: NPD Group.

Beauchamp, G. K., M. Bertino, and K. Engelman. 1983. Modification of salt taste. *Annals of Internal Medicine* 98(5 Pt 2):763–769.

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.

Bernstein, I. 1990. Salt preference and development. *Developmental Psychology* 2(4):552–554.

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

———. 1998. Psychological influences on the childhood diet. *Journal of Nutrition* 128(2 Suppl):407S–410S.

———. 1999. Development of food preferences. *Annual Review of Nutrition* 19:41–62.

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., and J. O. Fisher. 2000. Mothers' child-feeding practices influence daughters' eating and weight. *American Journal of Clinical Nutrition* 71(5):1054–1061.

Birch, L. L., J. O. Fisher, and K. K. Davison. 2003. Learning to overeat: Maternal use of restrictive feeding practices promotes girls' eating in the absence of hunger. *American Journal of Clinical Nutrition* 78(2):215–220.

Birch, L. L., and D. W. Marlin. 1982. I don't like it; I never tried it: Effects of exposure on two-year-old children's food preferences. *Appetite* 3(4):353–360.

Birch, L. L., L. McPhee, B. C. Shoba, E. Pirok, and L. Steinberg. 1987. What kind of exposure reduces children's food neophobia? Looking vs. tasting. *Appetite* 9(3):171–178.

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.

Borzekowski, D. L., and T. N. Robinson. 2001. The 30-second effect: An experiment revealing the impact of television commercials on food preferences of preschoolers. *Journal of the American Dietetic Association* 101(1):42–46.

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.

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.

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.

Center for Science in the Public Interest. 2003. *Pestering parents: How food companies market obesity to children*. Washington, DC: Author.

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.

Cheadle, A., B. M. Psaty, S. Curry, E. Wagner, P. Diehr, T. Koepsell, and A. Kristal. 1991. Community-level comparisons between the grocery store environment and individual dietary practices. *Preventive Medicine* 20(2):250–261.

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.

Contento, I. R., P. Zybert, and S. S. Williams. 2005. Relationship of cognitive restraint of eating and disinhibition to the quality of food choices of Latina women and their young children. *Preventive Medicine* 40(3):326–336.

Cutler, D. M., and E. L. Glaeser. 2003. *Why have Americans become more obese?* Cambridge, MA: Harvard Institute of Economic Research, Harvard University.

de Araujo, I. E., M. L. Kringelbach, E. T. Rolls, and P. Hobden. 2003. Representation of umami taste in the human brain. *Journal of Neurophysiology* 90(1):313–319.

de Castro, J. M. 1995. The relationship of cognitive restraint to the spontaneous food and fluid intake of free living humans. *Physiology and Behavior* 57:287–295.

———. 1999. Behavioral genetics of food intake regulation in free-living humans. *Journal of Nutrition* 7(8):550–554.

———. 2000. Eating behavior: Lessons learned from the real world of humans. *Nutrition* 16:800–813.

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.

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., and A. Barrett-Fornell. 2004. Do healthier diets cost more? *Nutrition Today* 39:161–168.

Drewnowski, A., N. Darmon, and A. Briend. 2004. Replacing fats and sweets with vegetables and fruits—a question of cost. *American Journal of Public Health* 94(9):1555–1559.

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.

Eaton, S. B., S. B. Eaton III, and M. J. Konner. 1997. Paleolithic nutrition revisited: A twelve-year retrospective on its nature and implications. *European Journal of Clinical Nutrition* 51(4):207–216.

Elitzak, H. 2001. Food marketing costs at a glance. *Food Review* 24(3):47–48.

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.

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., 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. 2002. *Shopping for health 2002*. Washington, DC: Author.

———. 2005. *Supermarket facts: Industry overview 2004*. Washington, DC: Author.

Food Research and Action Council. 2005. *Hunger in the U.S.* http://frac.org/html/federal_food_programs/federal_index.html.

Gallo, A. E. 1995. The food marketing system in 1994. In *Agricultural Information Bulletin No. 717*. Washington, DC: U.S. Department of Agriculture.

———. 1996. The food marketing system in 1995. In *Agricultural Information Bulletin No. 717*. Washington, DC: U.S. Department of Agriculture.

———. 1998. The food marketing system in 1996. In *Agricultural Bulletin No AIB743*. Washington, DC: U.S. Department of Agriculture, Economic Research Service.

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, J. Goldberg, and D. Snyder. 1998. Why Americans eat what they do: Taste, nutrition, cost, convenience, and weight control concerns as influences on food consumption. *Journal of the American Dietetic Association* 98(10):1118–1126.

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, et al. 1998. Environmental influences on dietary behavior among children: Availability and accessibility of fruits and vegetables enable consumption. *Journal of Health Education* 19:26–32.

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.

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

Johnson, S. L., L. McPhee, and L. L. Birch. 1991. Conditioned preferences: Young children prefer flavors associated with high dietary fat. *Physiology and Behavior* 50(6):1245–1251.

Kaminski, L. C., S. A. Henderson, and A. Drewnowski. 2000. Young women's food preferences and taste responsiveness to 6-*n*-propylthiouracil (PROP). *Physiology and Behavior* 68(5):691–697.

Keller, K. L., and B. J. Tepper. 2004. Inherited taste sensitivity to 6-*n*-propylthiouracil in diet and body weight in children. *Obesity Research* 12(6):904–912.

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, 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.

Lin, W., and I. S. Liang. 2005. Family dining environment, parenting practices, and preschoolers' food acceptance. *Journal of Nutrition Education and Behavior* 37(Suppl1):P47.

Lipton, K. L., W. Edmondson, and A. Manchester. 1998. *The food and fiber system: Contributing to the U.S. and world economies*. Washington, DC: Economic Research Service, U.S. Department of Agriculture.

Lowe, M. R. 2003. Self-regulation of energy intake in the prevention and treatment of obesity: Is it feasible? *Obesity Research* 11(Suppl):44S–59S.

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.

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.

Mela, D. 1993. Consumer estimates of the percentage energy from fat in common foods. *European Journal of Clinical Nutrition* 47:735–740.

Mela, D. J., and R. D. Mattes. 1988. The chemical senses and nutrition: Part 1. *Nutrition Today* 23(March/April):4–9.

Mennella, J. A., and G. K. Beauchamp. 1996. The early development of human flavor preferences. In *Why we eat what we eat*, edited by E. D. Capaldi. Washington, DC: American Psychological Association.

Mennella, J. A., and G. K. Beauchamp. 2005. Understanding the origin of flavor preferences. *Chemical Senses* 30(Suppl 1):i242–i243.

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.

Mertz, W., J. C. Tsui, J. T. Judd, et al. 1991. What are people really eating? The relation between energy intake derived from estimated diet records and intake determined to maintain body weight. *American Journal of Clinical Nutrition* 54(2):291–295.

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.

National Pork Producers Council. 2002. The kitchen survey. In *The kitchen report*. Urbandale, IA: Author.

Neel, J. V. 1962. Diabetes mellitus: A "thrifty" genotype rendered detrimental by "progress"? *American Journal of Human Genetics* 14:353–362.

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.

Pepino, M. Y., and J. A. Mennella. 2005. Factors contributing to individual differences in sucrose preference. *Chemical Senses* 30(Suppl 1):i319–i320.

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.

Putnam, J. J., and J. E. Allhouse. 1999. *Food consumption, prices, and expenditures, 1970–97 (Statistical Bulletin No. 965)*. Washington, DC: U.S. Department of Agriculture, Food and Rural Economics Division, Economic Research Service.

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

Rolls, B. J., D. Engell, and L. L. Birch. 2000. Serving portion size influences 5-year-old but not 3-year-old children's food intakes. *Journal of the American Dietetic Association* 100(2):232–234.

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.

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.

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

Seale, J., A. Regmi, and J. Bernstein. 2003. *International evidence on food consumption patterns (Technical Bulletin No 1904)*. Washington, DC: U.S. Department of Agriculture, Economic Research Center.

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.

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.

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.

Taras, H., M. Zive, P. R. Nader, C.C. Berrym, T. Hoy, and C. Boyd. 2000. Television advertising and classes of food products consumed in a pediatric population. *Journal of Advertising* 19:487–494.

Tepper, B. J. 1998. 6-*n*-Propylthiouracil: A genetic marker for taste, with implications for food preference and dietary habits. *American Journal of Human Genetics* 63(5):1271–1276.

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

Tepper, B. J., and R. J. Nurse. 1997. Fat perception is related to PROP taster status. *Physiology and Behavior* 61(6):949–954.

U.S. Department of Agriculture. 2000. Beliefs and attitudes of Americans towards their diet. In *Nutrition insight*. Washington, DC: Center for Nutrition Policy and Promotion, U.S. Department of Agriculture.

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.

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.