Children's Eating: The Development of Food-Acceptance Patterns

Leann L. Birch, Susan L. Johnson, and Jennifer A. Fisher

Editor's note: The practical advice in this article is what childrearing and early childhood education specialists have been giving to parents and teachers since 1940, but the research findings presented here help us see it in a new context and strengthen its impact.

For caregivers and parents, young children's health and well-being are of primary concern. Because we have been made aware of the important links between nutrition and children's health and growth, young children's eating (or not eating) can generate a high degree of anxiety in caregivers. The purpose of this article is to review what is known about the factors that influence the developing child's food-acceptance patterns, including children's sensory responsiveness, their innate preferences and ability to learn about food and the consequences of eating, and the effect of child-feeding practices on children's food-acceptance patterns. The term 'food-acceptance patterns' encompasses which foods are selected and how much is consumed. Our focus will be primarily on the evidence showing how early experience contributes to the development of food-acceptance patterns and the control of food intake. This information should be useful in designing strategies to foster the development of healthy patterns of food intake and in reducing caregivers' anxieties about child feeding. Because an extended discussion of the practical implications of these findings is beyond the scope of this article, we refer the interested reader to Ellyn Satter's two excellent books on child feeding for additional practical information (Satter 1986, 1987).

Early sensory responsiveness and food acceptance

In the absence of adult coercion, young children eat what they like and leave the rest. In making their food choices, they are blissfully ignorant of the caloric content and nutrient value and do not hesitate to express their likes and dislikes. These food-acceptance patterns begin in infancy with the reflexive facial expressions elicited by the basic tastes. The taste system is functional at birth: newborns respond with a positive expression to sweet and a negative expression to sour and bitter, and by about four months, they begin to show a preference for salt (Cowart & Beauchamp 1986). The infant's reflexive facial expressions in response to sweet, sour, and bitter are unambiguous. Adults viewing infants tasting sweet substances interpret the expression as "she likes it" and the responses to bitter and sour as...
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"he doesn't like it." In fact, one theory on emotional development posits that emotional expressiveness has its roots in these initially reflexive facial expressions (Chiva 1983). Caregivers interpret the infant's facial and gestural responses to foods and make decisions about whether to continue feeding a food, to stop the feeding, or to try a different food. The fact that these early responses to the basic tastes are reflexive ones suggests that food acceptance patterns may be "hardwired"—fixed and difficult to change, but research on the development of children's food-acceptance patterns reveals that this is not the case. The positive response to sweetness and the rejection of bitter and sour tastes are "built-in," but from very early in life, even responses to these basic tastes change with the child's repeated experience with food and eating.

Foods are complex stimuli, and they provide input to several sensory systems in addition to taste. Foods have textural components (such as crunchiness, creaminess, or greasiness), and the smell of food contributes greatly to much of what we commonly refer to as the taste or flavor of food. A food's appearance also can influence its attractiveness. Thus, our food preferences result from our response to a complex combination of stimulation, involving the food's taste, smell, appearance, and tactile characteristics. Children's responses to these characteristics are strongly influenced by prior experience with the food.

If we look at diets across cultures, dramatic differences exist in what substances are considered food, in what items tend to be valued and preferred, as well as in which substances are seen as unappealing or disgusting (Fallon, Rozin, & Pliner 1984). Humans are omnivores.

This means that we need a variety of foods to obtain adequate nutrition, unlike specialized species who can survive on one or a few foods. Along with this need for variety comes the ability to adapt readily to consuming whatever edible substances happen to be available in our environment. This adaptability implies that learning and experience must play central roles in shaping our food-acceptance patterns.

Although there is striking cross-cultural diversity in adult diets, as mammals we all begin life consuming an exclusively milk diet. By the time children are 5 or 6 years old, they are consuming many of the foods that make up the adult diet of their culture, and within that cultural group they will have developed individual patterns of food likes and dislikes; for example, many American 6-year-olds love hamburgers, but in India a Hindu child would probably find the idea of eating a hamburger disgusting. From a developmental perspective this implies that learning occurs relatively rapidly in the first few years of life.

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In some of our initial research on children's food preferences, we investigated the question of which of the many dimensions of foods are central in forming children's food preferences (Birch 1979); for example, how central are textural characteristics relative to the food's flavor in determining whether a food will be accepted or rejected? Our initial work revealed that sweetness was a primary determinant of children's preferences for foods, and this came as no surprise; however, a second factor, familiarity, was also important in determining preference. This is not a characteristic of the food but a function of the child's experience: children tended to prefer foods that were familiar over those that were not, relatively independent of the foods' sensory characteristics. Based on that observation we have conducted a program of research designed to investigate how children's early experience with food and eating shapes the development of their preferences.

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and food-acceptance patterns. Much of that work will be reviewed in this article. This work has practical implications for constructing social and physical settings for child feeding, and these points will also be developed.

**earned food preferences: Repeated exposure and associative learning**

Infancy and early childhood involve a dramatic dietary transition from consuming an exclusively milk diet to eating a variety of foods; at one point, all foods were new to the child. To obtain adequate nutrition, children must come to accept some of the new foods that parents offer. However, in general, infants and young children do not readily accept new foods (unless they happen to be sweet!). We have investigated this rejection of the new, or neophobia, and how children's initial rejection of new foods can be altered. Fortunately, many of children's initial rejections of new foods can be changed to acceptance. Why? By simply providing the child with a number of opportunities to sample the new food.

In several experiments we have shown that as exposure to a food increases, so does the child's preference for the food (Birch & Marlin 1982). We offered samples of new foods to children repeatedly during the course of their ongoing preschool program. We encouraged the children to take a small taste of the food, and we compared the changes in preference that resulted from this procedure to changes obtained when the child did not taste but only looked at and smelled the food (Birch, McPhee, Shoba, Pirok, & Steinberg 1987). Repeated exposure enhanced acceptance only when children actually tasted the foods; looking at and smelling the food did not increase children's acceptance. These changes in acceptance of new foods occur relatively slowly, often requiring 10 exposures before clear changes in acceptance are achieved (Sullivan & Birch 1990).

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Unfortunately, in many cases children don't have repeated opportunities to eat new foods because caregivers often interpret the child's initial rejection as reflecting a fixed and persistent dislike of the food. If the caregiver views the child's initial rejection as reflecting a dislike that cannot be altered, then she may not serve this food to the child again. As a result, caregivers may become frustrated and anxious about feeding the child, possibly resorting to coercive feeding techniques, which can have a negative impact on food selection and the regulation of energy intake (see "How parents influence their children's eating behaviors" on p. 77). In addition, the child may learn to accept few foods and may be labeled as "finicky" or as a "picky eater." Results of several experiments indicate that if caregivers are willing to persist in offering a new food, repeated exposure can be a slow but effective means of expanding the variety of foods that children will accept. The effect of repeated exposure on food acceptance is not restricted to young children; it is also effective with infants (Sullivan & Birch 1994) and adults (Pliner, Pelchat, & Grobinski 1993).

Research with animals reveals that changes in food acceptance resulting from repeated exposure are probably a result of "learned safety" (Kalat & Rozin 1973). This means that when the child learns (via repeated consumption) that eating the new food is not followed by illness, the food is gradually accepted. Putting edible substances into the body is a risky business: they can be toxic. Viewed in this light, the child's initial rejection of new foods takes on an adaptive character. Rather than reflecting a lack of cooperation or negativism, the child's rejection of new foods can be viewed as a normal, adaptive, protective response. Over time, when the consumption of a new food is not followed by nausea and vomiting, the child ultimately accepts the food. Conversely, when eating is followed by such negative consequences, a conditioned aversion results, and the child rejects and avoids the food.

**Based on these findings, we encourage caregivers to be persistent and to continue to offer new foods that are initially rejected. A schedule that includes two opportunities to try the food each week seems to work well. The child should not be coerced but should have the chance to taste the food in an unpressured setting. Our recommendation to parents and caregivers is to set a clear and consistent expectation that the child will taste new foods when they are offered. This policy works best if initiated when the child first begins to try new foods. during late infancy prior to the increased autonomy and independence of the toddler period. By the time the child reaches the "terrible twos," a time when many of the child's experiences with new foods occur, eating can easily become a focal point for power struggles. and having a well-established routine for tasting new foods can minimize negative interactions surrounding feeding.**

**Contributions of associative learning to food-acceptance patterns**

**Social context**

We have indicated that our food likes and dislikes are influenced by learning, most of which occurs in the absence of explicit teaching, during children's routine experiences at mealtimes. Young children eat frequently during the day and thus have many opportunities for experiences that can shape their food-acceptance patterns. For young children, eating is a social occasion because they need help; they cannot yet prepare and serve their own food, and they may also need help in feeding themselves. Siblings, peers, and adults are often present at meals and snacks, when they can serve as
models. In fact, we have seen that one way to increase children’s acceptance of disliked vegetables is to expose children to peers who happen to like the disliked food (Birch 1980).

Caregivers may attempt to control the child’s eating via a variety of child-feeding strategies. The emotional tone of the social interactions surrounding feeding can shape children’s food–acceptance patterns when associations are formed between food and the child’s emotional response to the feeding interaction. Meals are an important context for family or child care staff–child interaction, and meals also have a temporal structure that has meaning. Children learn very early that certain foods are served in particular order at meals and that particular social occasions require special foods. Even 2-year-olds can tell you what foods should be served at birthday parties and that dessert comes after the vegetables. In Western cultures, sweet desserts come at the end of the meal, probably because we still find them palatable even when we are relatively satiated, after consuming other courses. This sequencing of courses in Western cuisines fosters the use of sweet, palatable foods as effective rewards for finishing the previous course (“Finish your vegetables and you may have dessert”). We have investigated the impact of the use of foods in these social contexts on the formation of children’s preferences for foods, and these findings reveal that some common feeding practices may have unintended and untoward effects on children’s food–acceptance patterns. When foods are given to children in positive social contexts (as rewards, or paired with positive social interaction with an adult), children’s preferences for those foods are enhanced (Birch, Zimmerman, & Hind 1980). The opposite effect on food acceptance can occur when caregivers force children to eat “nutritious” foods to obtain rewards (“Eat your vegetables and you can watch TV”). The strategy of having a child eat a food in order to obtain a reward tends to reduce the child’s liking for the food she is rewarded for eating (Birch, Marlin, & Rotter 1984). In summary, via associative learning, social contexts of feeding that are perceived by the child as positive enhance liking; those that are negative reduce liking.

It may not be immediately obvious how this associative learning can contribute to the formation of food–acceptance patterns inconsistent with good nutrition. This occurs because there tends to be a consistent association between foods and the social contexts in which they are given: foods presented in positive social contexts and as rewards tend to be palatable foods high in fat, sugar, and salt. These foods, preferred by children even without much prior experience, are the same foods that current dietary guidelines tell us to consume in moderation. While our findings reveal that these child-feeding practices can enhance children’s preferences for these foods, parents who use coercive feeding practices are often unaware of the effects these practices have on children’s food–acceptance patterns. The same parents are concerned that their children are consuming too many “unhealthy” foods that are high in fat, salt, and sugar and not enough healthy, nutritious foods.

Based upon the research presented above, we suggest that caregivers can increase the chances that children will come to accept a wide variety of foods by providing children with repeated opportunities to try new foods in positive or relatively neutral social contexts and by avoiding coercive feeding practices. Parents should be aware that while coercive feeding tactics (such as rewarding children for eating foods they do not spontaneously consume) may have the immediate effect of in-

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Caregivers can increase the chances that children will come to accept a wide variety of foods by providing children with repeated opportunities to try new foods in positive or relatively neutral social contexts and by voiding coercive feeding practices.

Increasing intake, they can also have negative long-term effects on children’s food-acceptance patterns.

Learned preferences for high-energy foods

We have seen that children’s preferences for foods are shaped by their innate reactions to the basic tastes in foods, and that via associative learning, the quantity and quality of their early experience with foods have a major impact on their developing food-acceptance patterns. Recent research has revealed that the physiological consequences of ingesting food can also modify children’s preferences and can influence how much of those foods is consumed. Children can learn to associate the flavor cues in foods with the physiological consequences of eating those foods. The clearest example of this sort of learning was mentioned earlier: the case of the conditioned aversion, which results when consumption of a food is associated with subsequent nausea and vomiting. This learning is very powerful, and even previously preferred foods may be consistently avoided after such an association.

Recent research has revealed that children also form associations between foods’ sensory cues and the positive physiological consequences (feeling pleasantly full, for example) that normally follow eating an energy-dense food. In this research, children were given repeated opportunities to consume fixed amounts of high- and low-energy-density versions of the same distinctively flavored food. The foods used included yogurt and puddings, which can be made either high or low in energy density by varying either the fat or carbohydrate content. When adults were asked to taste the different preparations, they could not tell with reliability whether the preparations were high or low energy, nor did they consistently prefer one preparation over the other. After repeated opportunities to eat these foods as snacks, children showed clear preferences for the high-energy versions, and this result was obtained whether the high-energy version was made with added fat or with carbohydrate (Birch, McPhee, Steinberg, & Sullivan 1990; Johnson, McPhee, & Birch 1991). The children’s preferences for the high-energy foods were particularly clear when they were hungry, providing additional support for the fact that preferences were mediated by the physiological consequences of the food’s energy density (Kern, McPhee, Fisher, Johnson, & Birch 1993). These findings indicate that, in addition to the child’s natural preference for the sweet taste, the child is biased to learn to prefer foods that are high in energy. This ability to learn to associate a food’s flavor cues with the physiological consequences of eating that food can be viewed as serving an adaptive function, especially in contexts of food scarcity. Forming associations between the food’s sensory cues and the food’s energy content would lead to learning to prefer foods with high-energy contents. In the United States today, where for many of us foods are readily available and overconsumption is our most prevalent nutritional problem, rates of obesity among children have increased more than 50% in the last 20 years (Dietz 1991). The ready availability of high-fat foods, their association with positive social contexts, and children’s predisposition to learn to like high-fat and other high-energy foods contributes, as every parent and teacher knows, to the increased incidence of childhood obesity. Reduced energy expenditure must be considered also as one cause of increased childhood obesity.

Children’s ability to regulate energy intake

Do young children “know” how much to eat? In the late 1930s Clara Davis observed that when presented with a variety of nutritious foods, children self-selected a diet sufficient to maintain adequate health. This pathbreaking research suggested that young children possessed an innate ability to regulate food intake, independent of adult supervision. Davis, however, pointed out that part of the “trick” of her experiment was providing children with a set of simply prepared, healthful foods from which they could choose (Davis 1928). In a recent series of experiments, we have been investigating how children’s responsiveness to the caloric content of foods serves as a control of food intake. In the initial studies

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we looked at whether children adjusted their food intake in response to differences in the caloric content of foods (Birch & Deysher 1985, 1986). This research was prompted by the earlier research of Davis, as well as that of Fomon (1974), which examined infants’ ability to adjust their milk intake in response to changes in the formula’s energy density. Fomon’s work revealed that infants older than six weeks adjusted the amount of formula intake according to the energy density of the given formula, consuming more of the energy-dilute formula and less of the energy-dense version.

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To determine whether the responsiveness to energy density seen in infants persisted into childhood, we first looked at the effect that varying the caloric density of a meal’s first course had on children’s food intake in subsequent meals. In these experiments children were observed during a pair of meals, eaten on different days. The meals, which consisted of a first and second course, differed only in the caloric content of the first course. The children first consumed a fixed amount of a first course (half a cup of yogurt, for example) that was either low or high in calories. A few minutes later the children were offered a variety of foods from which they could self-select a meal, consuming as much of the foods as they wished. We reasoned that if children were responsive to the caloric density of foods in controlling their food intake, they would eat less in the self-selected portion of the meal following the high-calorie first course. In fact, this is what children did; they adjusted their intake in the second course almost perfectly for caloric intake with the energy in the first course, so that their total caloric intake for the first and second meals were the same whether or not they consumed the high-calorie first course or the low-calorie first course. Our findings are consistent with the idea that children may possess the ability to regulate how much to eat based on the caloric content of the foods they eat. In fact, our experience has been that children may rely on this sensitivity to caloric density to a greater extent than do adults. When children and adults were presented with the same low- and high-energy courses, the children showed the most precise regulation of caloric intake (Birch & Deysher 1985). It appears that as we age, an increasing number of environmental and psychological factors can influence and even override sensitivity to internal cues that tell us how much to eat.

Our research indicates that children have some innate capacity to adequately “know” how much to eat based on foods’ differing energy density. This “knowledge” is manifest in a sensitivity to the caloric content of foods not only within a given meal but also over a number of meals. This may seem quite contrary to what parents and practitioners believe about children’s meal-to-meal eating behavior. For instance, children are often inconsistent in what and how much they eat, consuming large portions of food at lunch one day and very little of the food offered at lunch on other days. It is therefore not surprising that caregivers and practitioners often approach child feeding with concern and frustration, as children may seem incapable of meeting their energy needs without adult supervision or intervention. However, we have found that although children’s meal-to-meal energy intake is somewhat erratic, children are consistent in the total amount of calories they consume during 24-hour periods. In examining children’s caloric intake over the course of a 24-hour period, we found that total daily intake varied, on the average, by only about 10% (Birch, Johnson, Andresen, Peters, & Schulte 1991; Birch, Johnson, Jones, & Peters 1993). Although our measurements were made in a relatively controlled laboratory school setting, similar patterns of children’s food intake have been observed in other less-controlled contexts (Shea, Stein, Basch, Contento, & Zybert 1992).

Individual differences in the regulation of energy intake

The percentage of young American children being classified as obese has continued to increase over the last several decades, with current estimates indicating that 25% of young children are obese and nearly one third of young children are overweight (Dietz 1991). Casual observation reveals large individual differences among children in degree of body fatness, suggesting that all children may not be equally adept at adjusting what they eat in relation to how much their body needs.

We have begun to characterize individual differences in children’s ability to regulate energy intake and identify the influences that result in these differences. Recent experiments at our laboratory have begun to focus on the individual child to determine the kinds of relationships that exist between an individual’s eating behaviors and his body fatness. Building on our previous work, we investigated differences among children in their ability to respond to energy-density cues. Using our standard experimental procedure, on two separate occasions we gave children a drink that was high or low in calories; if a child received the high-calorie version the first time, the second time she drank the low-calorie version. A short time after the children finished the drink, they were invited to eat a self-selected lunch, that is, they chose what they wished to eat from a variety of foods that included a main dish, fruit, vegetables, and milk, as well as a dessert. We measured their energy intake at lunch on both occasions and from this information determined whether or not each child adjusted lunch intake in response to the caloric content of the first-course drink. In addition to collecting this consumption data, we also...
Meals are an important context for family or child care staff-child interaction. It is important that adults sit and eat with children and that the mood of this social situation is pleasant.

obtained information on the children's body-fat stores by measuring height, weight, and skinfolds. Our findings indicated that children varied in their ability to regulate energy intake and that this variation was related to their body-fat stores: the children who showed less evidence of regulating their energy intake also had the greatest body-fat stores. This indicates that a systematic relationship exists between children's ability to regulate energy intake, their eating style, and their weight outcome.

Individual differences in the accuracy of energy-intake estimation are probably due, at least to some extent, to genetic variability, that is, some genetic predisposition or familial similarity exists in patterns of body fatness and food-intake regulation, and these biological characteristics account for some portion of individual differences in body type. These predispositions can be shaped or altered by various environmental factors, however. These factors include food availability, the type and variety of foods consumed, and the more social aspects of feeding, such as parents'/caretakers' attitudes and behaviors related to food and eating. Parents' child-feeding strategies and parents' eating styles will be the focus of the last portion of this article.

How parents influence their children's eating behaviors

Research on parenting style and child development outcomes reveals that authoritarian or rigid control over children's behavior is associated with unfavorable developmental outcomes; for example, parents who use an overly restrictive style have children who are less self-reliant than are children of democratic parents. In contrast, democratic parenting fosters the development of a child's self-esteem and self-control (Baumrind 1973). Costanzo and Woody (1983) have developed a model whereby they associate problematic outcomes in children with overrestrictiveness of the parent. They suggest that parents, motivated by concern for their children, are likely to impose more control over their children in areas of development (1) that they value highly or (2) in which they believe that their child may be especially at risk. The researchers further suggest that parents' attempts to impose control inhibit the child's likelihood of developing self-control in that particular area of development.

Costanzo and Woody's model can be applied to the eating domain by considering the relationship between parents' child-feeding strategies and children's regulation of energy intake. Many parents impose rules and regulations regarding eating that are both implicit and explicit. These rules include such practices as using foods as bribes and rewards or making access to highly desirable foods contingent upon the consumption of less desirable ones ("If you finish your brussels sprouts, I will give you a cookie"). We have already presented evidence that these practices can systematically alter children's food preferences in directions incompatible with healthy diets. These control strategies can negatively affect children's food-acceptance patterns in a second way: decreasing children's ability to self-regulate energy intake (Birch, McPhee, Shoba, Steinberg, & Krehbiel 1987). When we instructed one group of children to focus on "cleaning their plates," or the amount of food remaining on the plate, these children were much less responsive to energy-density cues than children who had been taught to focus on internal cues, such as feelings of hunger or fullness. More recent work has revealed that parents who use controlling child-feeding strategies have children who are less likely to exhibit self-control in regulating their energy intake (Johnson & Birch 1993). We asked parents to complete the Child Feeding Questionnaire, an instrument designed to assess the degree of control parents use within the child-feeding domain. This questionnaire asks parents whether they believe that they need to regulate when and how much their children eat in addition to what they eat. The completed questionnaire also reveals information regarding the rules and regulations that parents establish with respect to eating. The children from these families participated in a pair of consumption trials to assess their responsiveness to energy-density cues of their diet. We found that parents who reported using more control over their children's food-intake had children who showed less evidence of self-regulation of energy intake (Johnson & Birch 1993). Furthermore, children who were less responsive to energy-density cues had larger body-fat stores. Together these findings suggest that parental control exerted to regulate the quantity of food that children consume results in a decrease in development of the children's self-control of energy intake and ultimately, perhaps, in increases in children's amount of body fat.
Conclusions for child care providers

A primary responsibility of parents and caregivers is to try to ensure that children are healthy. Part of providing an optimal environment for growth and health is to make sure that children get enough to eat and also that they consume a wide variety of foods. Parents and caregivers establish standards or rules about food and eating in part because they are concerned for children’s welfare. These rules provide children with the tools and information necessary to gain an understanding of the importance of healthy eating. Cuisine rules and rules of etiquette are necessary and positive when they provide the opportunity for children’s learning and allow for the development of proper eating behaviors (Birch 1993). But when these strategies are overpowering, when they control but do not empower the child, they become problematic.

Our research supports what parents and caregivers informed about good child development practice have been doing for the past 50 years: assume responsibility for providing children with a variety of healthful foods in a positive social environment and then allowing children the freedom to eat what they wish.

References


For further reading


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