



8945 Ridge Avenue  
Suite 3 - 4 - 5  
Philadelphia, PA 19128  
215-483-8558  
andorrapediatrics.com

## Food Acceptance Patterns: Children Learn What They Live

*Leann L. Birch, Ph.D., Professor and Head, Department of Human Development*  
*Karen Grimm-Thomas, Department of Human Development and Family Studies*

Infants are born as "univores," that is they require a single food source-human milk-for adequate nutrition. In order to continue normal growth and development beyond the nursing period, their parents must help them make the transition from dependent to independent self-feeding and learn to accept and enjoy the varied "omnivore" diet. This transition occurs gradually over the first two years of life and involves: 1) a shift from a single to Multiple food sources, 2) increased opportunities for self-regulation of food intake, and 3) new social contexts for eating involving peers and adult caretakers. The success of the transition from a single-food source to a multiple-food source diet is shaped by the availability of dietary variety, the quality of children's early feeding experiences and the ability of parents to accommodate their children's emerging independence. This article will explore the issues involved in the development of early food acceptance patterns, specifically demonstrating that a) there are few innate preferences and aversions; in general, children's likes and dislikes are learned, and b) parents can get their children to eat just about anything if they are willing to work at it. Hopefully the reader will be struck by how conventional methods that parents employ to get their children to eat (such as offering tasty treats for trying new foods or for cleaning their plates) may actually be counterproductive in light of the what we now know about the development of food acceptance patterns.

### The Innate Preferences and Aversions

Human infants are innately neophobic, that is they are instinctively afraid of anything new, and prefer to eat foods that are familiar. This preference for familiar food is normal and may very well be adaptive as it helps avoid the ingestion of potentially harmful foods.

Fortunately, along with the inborn hesitancy to accept new foods, human infants are also born with a well-developed sensitivity and preference for sweet taste. In fact, their sensitivity to sweet taste is so well-developed that within hours of birth, newborn infants can discriminate between the sweetness of two sugars and between different concentrations of the same sugar. They also show a preference for sugar solutions over both water and formula." This innate preference for sweetness means that the introduction of sweet-tasting fruits, such as apples and peaches, to the infant diet is usually a pleasant experience for both baby and parent.

Newborn infants display relatively consistent adverse responses to citric acid (sour taste) and concentrated quinine and urea (bitter taste). The facial expressions associated with sour and bitter tastes are also believed to be adaptive because they include mouth movements that would eject the offending tastant from the infant's mouth. This facial expression may be familiar to parents introducing bitter tasting foods such as green beans, spinach and kale.

The recognition or preference for salt taste is not evident in the newborn period and does not appear until four to six months of age. Although this postnatal change may be due to the maturation of salt-specific receptors on the tongue, early experiences with salted and unsalted foods also shape infants' preferences for added salt in foods.

The characteristics that enhance or detract from a food's palatability are many and varied. Taste is just one component. For example, the palatable nature of fat is not derived from a unique "fat" taste receptor on the tongue. Rather it is the volatiles that are carried in fat that add flavor and make foods containing fat palatable. The characteristics that fat imparts to foods differ quite dramatically across various food systems. Fats can make some foods greasy, some creamy, and some flaky as in the case of pie crust. There are no studies that currently suggest that the preference for fat is innate. Flavor (a combination of taste and smell), as well as texture, color, viscosity, temperature and irritation (such as the "heat" in hot sauce) are all very important to a food's perceived palatability

### **For the Most Part, Food Acceptance Patterns are Learned**

While innate taste preferences and aversions clearly exist and children usually prefer familiar foods to novel ones, their food acceptance patterns can be altered. The three factors that have greatest impact on shaping food acceptance patterns are 1) opportunities for repeated exposure to new foods, 2) the social context of meals, and 3) associative learning (either conditioned food preferences or conditioned aversions).

#### Repeated Exposure:

Given that babies and young children prefer to eat foods that are familiar, one approach for increasing children's acceptance of novel foods is to increase the food's "familiarity." Sullivan and Birch recently investigated whether newly weaned infants' acceptance of novel foods could be altered with repeated exposure. The data revealed that infants participating in the study dramatically increased their intake of vegetables, doubling their intake from about ~30g to about ~60g after five to ten exposures. An unanticipated result of the study was that breast-fed infants showed greater increases in their novel food acceptances than did bottle-fed infants. The authors hypothesize that this difference may be due to the fact that breast-fed infants experience a variety of flavors from the mother's diet via her breast milk, which may have made some flavors seem familiar. On the other hand, bottle-fed infants experience a single flavor throughout the nursing period, which would make all other food flavors seem new.

Unfortunately, parents often do not appreciate that their children's initial rejection of new foods is normal and that their children can learn to accept and enjoy new foods after repeated exposures to them. The commonly held view is that the initial rejection of a food is a signal of their child's fixed, immutable dislike for it. As a result, parents do not provide repeated experience with the food, and deprive their child of the opportunity to learn to like it. Before long, the parents come to believe they have a "picky eater" on their hands. The problem can easily be overcome if parents repeatedly offer new foods in a positive, patient manner.

Studies with children have found that experience also plays a role in the acquisition of preferences for food-flavorant combinations.' " Sullivan and Birch found that when four-year-olds were randomly assigned to receive repeated experiences with either sweetened, salted or plain tofu (a food unfamiliar to all of the children prior to the experiment), a preference for the experienced food-flavorant combination was enhanced across all three groups. With respect to a generalization of the flavorant preference, none was noted, which indicates that the preferences for the flavorants were context-specific and limited to the tofu-flavorant combination. Further, the children who experienced either the sweet- or salty-flavored tofu preferred the plain even less than when it was completely novel at the

beginning of the experiment. The same was true with regard to sweet and salty-flavored tofu for children who repeatedly experienced the plain tofu. These results indicate that, with repeated exposure and in the absence of an aversive presentation context or consequence, children will learn to like what they are given to eat.

### **Social Context:**

Routine family meals teach children about their culture's rules of cuisine, that is, which foods their culture finds edible and which it does not. For example, by watching what others eat and don't eat, children learn which foods are "dangerous and which are not. They also learn what is perceived as "disgusting." In our culture it may not be dangerous to eat insects or dogs, but it would be considered disgusting by most Americans' standards. Routine mealtime experiences also teach children which food combinations their culture finds acceptable and which it does not. In the US, ketchup on hamburgers is commonly enjoyed, but ketchup on apples is not. Finally, rules of cuisine dictate which meals are eaten at which times of day and what foods are typically eaten at these meals.

Importantly, parents' predisposed beliefs about the anticipated acceptance or rejection of a food vary from culture to culture and can affect the parents' feeding behavior with regard to that food. For example, in the US culture, children are expected to dislike spinach, but in Japan, children are expected to like it. These expectations shape the feeding interaction between the parent and child and, ultimately, influence the child's acceptance of a particular food.

### **Associative conditioning:**

Children also learn food acceptance patterns through associative conditioning, which is simply the pairing of something in the environment with something else, resulting in a new response.

Probably the best example of associations with consequences are "conditioned aversions." A mealtime example of this would be the case in which you eat something and get sick afterwards. The next time that food is offered to you, you might say, "Ugh. No thank you." Most everyone has at least one food that they will not eat because it made them ill on one occasion. There is evidence that people retain these aversions decades later-even when the aversions are formed after only one pairing. Novel foods are particularly vulnerable to conditioned aversions."

A series of experiments conducted on developing food preferences found that common child feeding practices can actually create conditioned dislikes for healthy foods that parents want their children to consume. An example would be when parents routinely use sweet rewards to induce their children to eat their vegetables. The results of these experiments found that the children's preferences for the vegetable offered declined with this pairing, and their preferences for the highly palatable foods was enhanced-clearly the opposite of their parents' intended affect.

Similarly, studies investigating a related maneuver, using palatable foods as rewards for children's performance of desired behaviors, such as cleaning their plates or sitting quietly in the car, found that this pairing did have a positive effect on children's behaviors, but it also increased their preferences for the "reward" food." These were foods such as snack crackers and dried fruits, for which the children initially had neutral preferences. The increases in the children's preference for the "reward" foods persisted eight weeks later. In this particular experiment, increases were also seen in the children's preferences if the foods were offered in the context of a positive social interaction. If an adult said, "Hi Johnny, how are you today? Have some of this," the preference for the food still increased. However, if foods were presented non-socially and just left out on a counter as something the children could eat, there was no change in the children's acceptance of them.

Pairing the digestive response to the nutritional properties of foods with certain flavors can also increase a food's acceptance. Birch demonstrated that repeated experiences with flavored drinks of varying caloric density appear to alter children's preferences for specific flavors. In one study, young children came to prefer the taste of a high energy cherry drink over a low-energy almond drink. Likewise, significant changes were also seen in children's preferences for a high-energy cherry flavored drink versus their preference for a low-energy cherry drink. It may be that, similar to the innate aversion to bitter and sour taste, children's ability to learn to prefer foods with high sugar and fat contents is also an adaptive process. In situations where food is scarce, learning which flavors predict high energy content-and learning to prefer those foods- would be beneficial.

The practical questions that remain, then, are: Can children learn to effectively regulate their energy intake in the face of a preference for easily available high energy foods. And, why is it important that children like what they eat?

## **Food Acceptance Patterns Influence Intake Patterns**

Teaching children to accept and enjoy a variety of nutritious foods is important because children's food acceptance patterns influence their intake patterns which is to say that children generally eat what they like. The classic research by Davis demonstrated that, if offered a variety of nutritionally, appropriate foods, newly weaned infants and young children will self-select a healthy diet and regulate their intake over the course of several weeks or months. Moreover, Advise reported that the children's energy and macronutrient intake were well within the current guidelines. The children obtained 35% of energy from fat and 17% from protein. They grew well and suffered few childhood illnesses. The size and composition of the individual meals varied dramatically, and the children rarely consumed more than two or three of the ten to twelve foods presented at any given meal.

They also went on "food jags," eating only one or a few foods for several meals, then abandoning those foods in favor of others. Of course, the "trick" of this study, as Davis herself acknowledges, is that the children were only exposed to nutritious foods. No doubt the study would have had vastly different findings had the children been allowed to choose from the full complement of foods currently available on supermarket shelves.

Infants as young as six weeks old can regulate their energy intake. Research with two to five years olds has shown that, absent adult coercion and control, children have some capacity to regulate their caloric intake." Three year olds who are allowed to make independent food choices will alter their dietary intake depending on the caloric content of the foods served at the meal. They also will eat more at a meal that follows a low caloric meal than at one that follows a high caloric meal. And lastly if given repeated experience with a specific food, young children can learn to associate the flavor cues in that food with the post-ingestion consequences, and regulate their intake accordingly in subsequent encounters with the food. Interestingly, children apparently do a better job of listening to their hunger and satiety cues and regulating their food intake than their parents do."

Which foods children will consume at a meal is affected by the energy density of the foods consumed at the previous meal. Data on children's food preferences reveal that following a high energy first course, children will eliminate less preferred foods from a subsequent course, and continue to consume their preferred foods. Their preferred foods will tend to be relatively energy dense ones with high levels of sugar and fat, and those not eaten will tend to be good sources of micronutrients and generally lower in energy density."

## **Passing Eating Patterns From One Generation to the Next**

How parents handle their own food intake has a profound impact on their children's food acceptance,

preference and intake patterns. One study found that children who preferred high fat and calorie-dense foods, have parents who also preferred them. Moreover, both the children who preferred the high fat foods and their parents had greater body mass indexes (BMI) than the child-parent pairs who had lesser preferences for these foods. This suggests that the high BMI parents are eating diets higher in fat and their children have ample opportunity to learn to like these foods. Therefore, with regard to fat intake, these parents are transferring their food preferences and intake patterns to their children.

Children's food preferences influence not only the types of foods that children will consume, but also the overall quality of their diets. In addition to finding significant correlations between children's preference for high fat foods and their parent's preference for them, the study with preschool children<sup>18</sup> found that children's preferences for high fat foods were significantly related to their selection and consumption of high fat foods and total dietary fat intake. Although the same menu was offered to all of the children, their food selection patterns produced variability in the quality of their diets. This research indicates that while the nutritional adequacy of young children's diets is constrained by the foods provided to them, children's choices from among those foods exert a considerable influence on the overall quality of their diets. Therefore, providing children with a variety of healthful foods from which to select their diets is essential, but not sufficient to ensure nutritional adequacy.

The appetite regulatory mechanism is a potentially important one in the maintenance of healthy weight. However, it is also very easy to turn off given that parental feeding practices often focus children's attention away from internal satiety cues, and direct them toward social cues of how much and when to eat, and on how much food is left on the plate. Parents who try to control what and how much their children eat impede their children's ability to regulate their energy intake, which can in turn, create higher adiposity and greater fatness in their children, particularly in girls. Recent studies have shown that parents who do not trust their own intake regulation controls (e.g., they are either obese or constantly dieting), send signals to their children that internal hunger and satiety cues cannot be trusted and external controls need to be employed. The best predictor of children's responsiveness to energy density is parenting style in the feeding context. Johnson and Birch found that children's ability to regulate their energy intake was inversely related to the imposition of authoritative parental controls during eating.

## **How parents handle their own food intake has a profound impact on their children's food acceptance, preference and intake patterns.**

### **Parents can shape their children's healthy eating patterns**

For better or worse, parental food acceptance and intake patterns become deeply ingrained in the "nutritional psyche" of their children. Parents who model a healthy attitude toward eating, including listening to their internal hunger and satiety cues and eating a variety of nutritious foods, can shape their children's food acceptance patterns early in life and help them develop healthy eating patterns. The following are practical suggestions for parents to consider:

- Offer repeated exposure to variety of healthy foods. Children learn to like the foods that are made available to them. Be patient, as many as eight or 10 exposures may be needed.
- Start early. Make tasting new foods a pleasant family routine during infancy.
- Parents need to watch what they eat too because their children's willingness to try new foods is shaped by the way others in the family respond to them, either favorably or unfavorably.
- Watch the contexts in which all foods are presented or withheld. Rewarding children for eating a particular food only increases their dislike for the food. Subconsciously, children must be thinking, "Gee, if he/she has to reward me for eating this stuff, it must not be very good." It is easy to turn eating into work. Avoid statements like, "Finish your spinach, then you can go out and play."

- Respect children's ability to regulate their energy intake. It is very easy to turn off children's responsiveness to energy density intake cues and focus on how much is on the plate. Children who say, "I'm not hungry anymore," and consistently hear their parents say, "Finish what's on your plate," are going to feel their internal satiety cues are irrelevant. While it is the parents' responsibility to provide an array of healthful food choices at regularly scheduled meals, it is up to the children to decide what and how much they will eat (or whether they will eat at all).
- Parents need not severely restrict their children's access to highly palatable foods (such as those high in sugar, salt and fat) because restricted access may make these "forbidden" foods even more attractive to children.

## Conclusion

If twenty years of research into infant food acceptance patterns could be summed up in a few sentences, they would be: You can get children to eat almost anything if you work at it. There are a few innate preferences, however, likes and dislikes are essentially learned. And, we need to examine more closely what it is we are doing when we teach children to prefer the high-fat dietary patterns that the majority of Americans eat. As far as facilitating healthy eating patterns, parents need to provide a variety of healthy foods at regularly scheduled meals, and allow their children to determine what and how much they will eat.

This strategy will help children learn to accept and enjoy a variety of nutritious foods and develop healthy eating patterns that can last a lifetime.

This information should not be used as substitute for the medical care and advice of your child's physician. Health related topics found on the Andorra Pediatrics web site should not be used for diagnosing purposes or be substituted for medical advice. As with any new or ongoing treatment, always consult your professional healthcare provider before making any changes in treatment or beginning any new treatment. If you have any questions or concerns, please call our office.