

Acquisition of Food Preferences and Eating Patterns in Children

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Abstract

As mammals, we begin life on an exclusive milk diet, and during the first years of life, we must make the transition to the modified adult diet of our culture. To maintain growth and health, we must accept some of the foods offered to us. The factors that influence the formation of food acceptance patterns during the first years of life are reviewed, within a framework that includes genetic predispositions and environmental influences. Phenotypic food acceptance patterns arise from the interaction of genetic predispositions with environmental factors, in the context of everyday eating occasions. Ways in which children's food acceptance patterns are influenced by early experience are described. Child feeding practices are a focus of this review, as they have a profound influence on the child's early experience with food and eating. For young children, parents and other care-givers shape the early food environments by determining what foods will be offered or withheld, the timing and size of meals and snacks, and the social context of eating occasions. The latter includes peers, siblings and parents, who may serve as models for children's eating. In addition, parents often employ child feeding strategies designed to control what and how much children eat. These child feeding strategies include encouraging children to eat foods parents believe are good for them, and restricting children's access to "bad", unhealthy or "junk" foods. These strategies are used to bring children's diets into line with what parents believe children should eat. However, effects of these practices are counter to what parents intend, and findings suggest that they may have adverse effects on the development of children's food preferences and the controls of food intake. Understanding the effects of common child feeding practices on children's intake may provide insights into how child feeding practices may contribute to secular increases in childhood overweight.

Introduction

As mammals, we all begin life on an exclusive milk diet. During our first years, the transition to a modified adult diet takes place; to maintain growth and health, the infant must learn to accept at least some of the foods offered. Individual differences among children in the controls of food intake begin to emerge during this early transition period. As children's genetic predispositions are modified by learning and their experiences with food and eating, food preferences and more adult-like controls of food intake begin to emerge. Early experiences with food provide learning opportunities that are critical in the formation of food preferences and the controls of food intake. Parents play a central role in shaping the child's food environment and early experience with food and eating. They influence the development of food acceptance patterns by structuring children's early experience with food. The choice of foods to offer and the child-feeding practices parents use also have enduring effects on food preferences and the controls of food intake. In this presentation, the development of food preferences and eating patterns during infancy and childhood are addressed; possible links between children's patterns of food intake and childhood overweight are discussed; and implications for anticipatory guidance of child-feeding are presented.

Prevalence and Etiology of Childhood Obesity

Among children and adults, overweight and obesity are increasing worldwide (1). In the U.S., the prevalence of childhood overweight has increased among pre-school children as well as older children and adolescents from the 1970s to the 1990s (2). The health costs of the rise in childhood overweight are predicted to be enormous, given the links between obesity and a variety of chronic diseases, including cardiovascular disease and diabetes (1). At this point, we have no effective public health prevention or treatment programs for childhood obesity. An understanding of the factors involved in the etiology of obesity will be essential to successful prevention and treatment. Overweight and obesity result when energy intake exceeds expenditure; both sides of the energy balance equation are implicated in determining weight status. In this review, the focus is exclusively on the child's developing controls of food intake and possible links to the etiology of childhood overweight.

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Familial patterns of overweight are widely recognized. The child of overweight parents is at greater risk for overweight (3). Childhood overweight is the result of an interaction in which genes and environment work in concert to produce overweight. Parents provide both genes and the food environment during the early years of life (4). We can't alter the child's genetic predispositions, but the feeding environment is subject to modification. The very rapid increases in the prevalence of obesity and overweight in recent decades underscore the role of the feeding environment in the current epidemic of childhood overweight, as genetic changes are far too slow to produce such dramatic increases (5).

Parents shape children's feeding environments from birth and even prior to birth (6). At birth, the parents' choice to breast feed or formula feed has implications for subsequent food acceptance patterns (7,8). Once the transition to solid foods begins, parents have the opportunity to shape the child's food environment by offering some foods and not others, and by the social contexts in which children's eating occurs. For children, eating is usually a social occasion, complete with other eaters who can serve as models and parents and others who may attempt to control children's intake. Social factors influencing children's food choices and requests for foods include imitation and modeling, as well as television advertising and media exposure (9). Child-feeding practices used by parents can also have effects on the developing patterns of food intake in children. A review of these effects will be a major focus of the remainder of this presentation. While we have long known that parents' weight status predicts the child's weight status, we have recent evidence that parents' own dieting and weight control practices affect children's developing controls of food intake and overweight (10,11,12). These effects are both direct and indirect, and reflect both genetic and environmental factors. Parent's weight status predicts the child's weight status (3), and parents' eating patterns can serve as models, directly influencing children's patterns of intake. Parents' eating and weight history can also shape their child-feeding practices, which in turn influence patterns of food intake.

The Development of Food Preferences: Genetic Predispositions and the Food Environment

Eating is a major source of pleasure in daily life. It has been suggested that the pleasures we experience from the essential activities of eating and sex help to ensure the survival of the species (13). For children, as well as for adults, food preferences are major determinants of food intake, and this is particularly true for children (14,15), for whom factors that influence adults' intake patterns, such as cost, nutritional value, and ease of preparation, are irrelevant. Preferences for dietary fat have been linked to food intake and degree of overweight (15,16,17). With respect to links between preferences and intake, our previous work found that children's preferences for high-fat foods predicted their intake of those foods, as well as their degree of overweight.

Infants come into the world equipped with genetic predispositions to prefer sweet and salty tastes, reject sour and bitter tastes, and to reject new foods. The work of Steiner (18) first revealed that even prior to any postnatal experience, infants respond reflexively to sweet, sour and bitter tastes with facial expressions that are read by parents as liking, dislike and distaste, respectively. An additional predisposition involves the tendency to reject new foods, which has been termed "neophobia", fear of the new. Neophobia can impede children's acceptance of new foods, but can be transformed to acceptance via experience with eating new food (7,19,20,8). These early predispositions interact with early environmental experience to shape food acceptance patterns, and children learn a great deal during the first years of life. For example, they learn what is edible and what is disgusting within their culture, as well as what to like and how much to eat, and when to eat. They also begin to acquire cuisine rules regarding flavors that should and should not be combined and the times of day when foods are eaten.

Because early learning and experience are central in the development of food acceptance patterns, the early food environment is very important in shaping acceptance patterns. As omnivores, humans need dietary variety to obtain adequate nutrition. However, as our hunter-gatherer ancestors discovered, ingesting a potential new food can lead to illness or even death. Probably for this reason, humans, including young children, exhibit "neophobic" reactions to new foods. When children are presented with a new food for the first time, they tend to reject

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it. In general, children can only learn to prefer foods if they are made available to them. Fortunately, the child's initial neophobic response to a new food can be reduced by eating the food, at least when eating is followed by positive post-ingestive consequences, such as pleasant feelings of satiety.¹ Post-ingestive signals can also serve to shape children's preferences for energy-dense foods over energy-dilute foods; because fat is very energy dense, children can learn to prefer high-fat over low-fat foods (21). This type of flavor-nutrient learning, in which flavors of foods become associated with the post-ingestive consequences of ingested nutrients in the foods, has been widely demonstrated among other species of omnivores (22), and can contribute to the reduction of neophobia and children's preferences for energy-dense foods, high in fat and sugar. Learned preferences for high-fat, energy-dense foods make adaptive sense in environments where food is scarce and energy-dense foods are not readily available; but such learning may be a liability in cultures such as ours, where energy-dense foods have become inexpensive and readily available.

With respect to the neophobic response, and learning to like new foods, it is important to make parents and caregivers aware of the fact that as infants begin the weaning process, all foods are new, and many will be initially rejected. Sullivan and Birch (8) trained mothers to repeatedly present new pureed foods to their infants during one feeding each day over a series of days. As a result of a series of 15 feedings of the new food, infants' intake of the new food more than doubled, on average. Furthermore, the effects of experience differed as a function of prior feeding method: breast-fed infants showed greater increases in intake of the new food than did formula-fed infants. This suggests that the more limited flavor experience of formula-fed infants may impede their acceptance of new foods or may foster the neophobic response.

¹ When ingestion of a new food is followed by nausea or emesis, a learned aversion to the food is likely to result.

The Impact of Child Feeding Practices on Children's Eating

Current U.S. dietary guidelines (23) include recommendations to consume a variety of foods and to choose diets that are moderate in sugar and salt and low in fat. In a context in which large quantities of palatable foods high in sugar, salt and fat are readily available, it is no coincidence that the recommendations directly oppose our predispositions to prefer sweet and salt, and our learned preference for foods high in fat and energy. Making recommendations is relatively easy, but the real challenge for parents is to find ways to use these recommendations to achieve healthier diets for children. The evidence suggests that we have a long way to go before children's diets are consistent with current recommendations. A recent U.S. survey of 4,000 youth from age 2 to age 19 revealed that 45% of children's energy intake came from discretionary sugar and fat, and the majority of children were not meeting dietary recommendations (24).

What is a parent to do, in the face of the rising prevalence of overweight, to reduce children's sugar, fat and salt intake to moderate levels? In the U.S. these days, restricting children's access to energy-dense, palatable foods is a common child-feeding strategy. To parents, this seems a reasonable approach to limiting children's intake of these foods. Dietary restriction is also the most common strategy used by those dieting for weight control, especially women. Parents report restricting their children's access to foods they believe to be "unhealthy for them"—those at the top of the food guide pyramid, including sweet and savory snacks and candy. An additional strategy is to pressure children to eat foods that are "good for them," the fruits, vegetables, and complex carbohydrates that should be consumed in greater quantities, which appear at the bottom of the food guide pyramid.

Recently, we have been investigating the effects of these child-feeding practices on the developing controls of food intake (11,25). In this research, we have questioned parents about the extent to which they restrict children's access to "unhealthy" snack foods. We have then related their use of restriction to children's intake of restricted foods in a setting where the foods are freely available and parents are not present to restrict access. We have also related mothers' reported use of restriction in child feeding to other maternal and child characteristics (maternal BMI, maternal dieting) to measures of children's intake of restricted foods, and to children's weight status. Results of several studies (4,6,11,25) reveal that maternal

restriction actually *increases* children's intake of the restricted foods when children are given free access to those foods. These effects are much stronger for girls than for boys; and mothers who report using higher levels of restriction also have higher levels of dietary restraint. Mothers also use more restriction with heavier girls, raising the question of the directionality of these findings. We have proposed that the effects of parental restriction on children's developing controls of food intake are similar to the effects of the self-imposed restriction on adult dieters: chronic restriction can eventually lead to the breakdown of restraint, "out of control" overeating of restricted foods, and negative self-evaluation.

In an ongoing project, we are investigating the developing patterns of food intake in 200 girls from age five to age nine and in their parents. Because dieting and overweight are pervasive in the U.S. today, especially among women, and because the prevalence of overweight seems to be increasing most rapidly among young girls, we have focused on links between developing patterns of food intake, the development of overweight and the emergence of dieting among girls. We are especially interested in how mothers' own dieting and weight concerns may shape their child-feeding interactions with their daughters. We have tested a model relating maternal factors, including BMI and dietary self-restraint to use of restriction in feeding, to examine how maternal restriction relates to daughters' intake and weight status (26).

The results that appear in Figure 1 were obtained using structural equation modeling. Arrows show the directionality of relationships, and the path coefficients can be interpreted as standardized regression coefficients, similar to correlation coefficients in this case, with zero indicating no relationship, and 1.0 perfect positive relationship. Each relationship shown is adjusted for all the others in the model, and all paths shown depict significant relationships. Results indicated several things. First, mothers' perceptions of daughters' weight status and mothers' own dietary restraint predicted the extent to which mothers reported restricting their daughters' intake. In turn, maternal restriction predicted daughters' ability to control energy intake. Daughters' intake of snack foods in the laboratory setting predicted daughters' weight status. Essentially, mothers who used more restriction had daughters who, in the absence of hunger, ate more of palatable snack foods

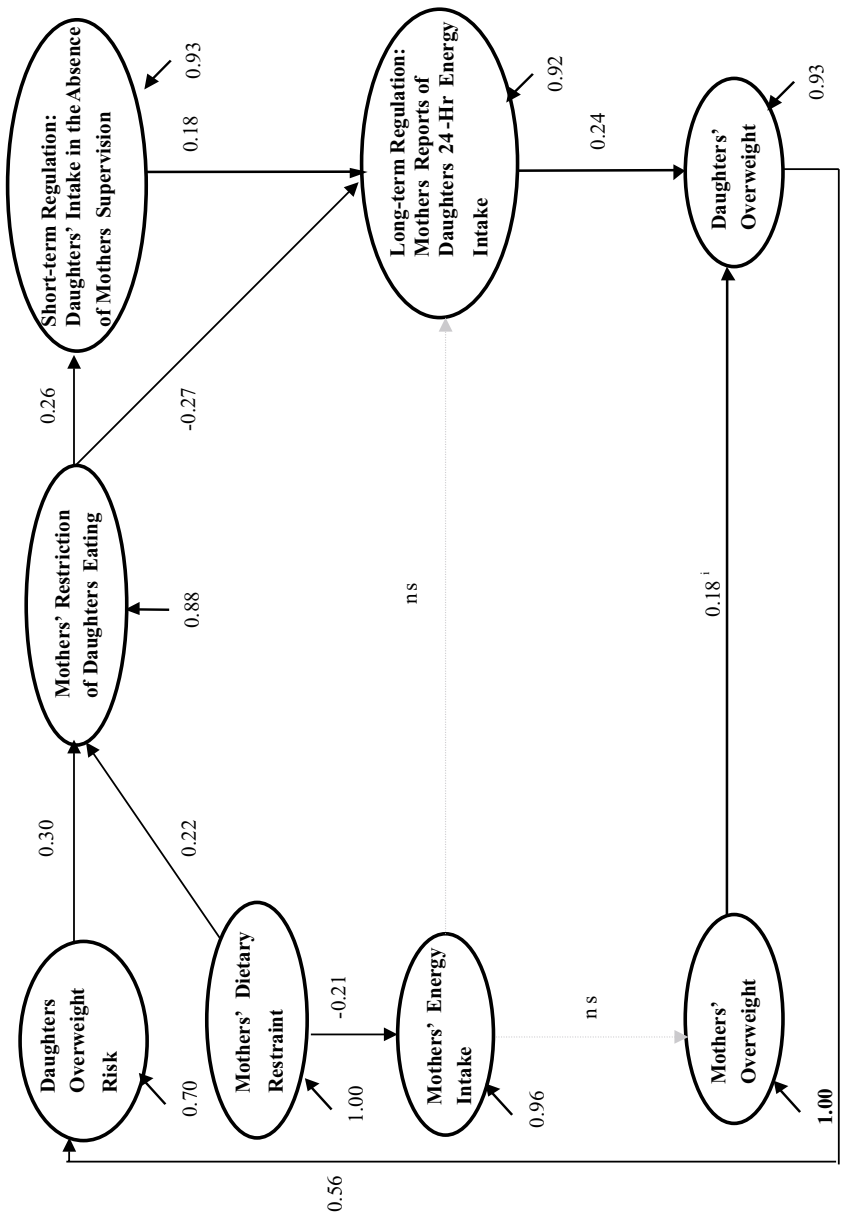


Figure 1 - A structural equation model testing the influences of the family environment on girls' eating and weight outcomes

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when they were available, indicating a heightened response to the presence of palatable food, and a consequent reduction in the ability to regulate energy intake in response to hunger and satiety cues.

Overall, the results of several studies indicate that restricting children's access to foods can lead to enhanced preferences, increased attention to restricted foods, increased intake of those foods, even when not hungry, and negative self-evaluations. Eating more food in these settings is linked to girls' weight status (10), but no relationship was obtained for boys. One unanswered question is whether these findings reflect differential treatment of boys and girls in the feeding context. There is evidence that parents use "domain-specific parenting", imposing more stringent controls in areas of children's development that are particularly important to them, or in which they think the child might be at risk for problems. For example, no parents want their children to be obese, but current social norms dictate that being "big" may be more acceptable for boys, while being thin is a more integral part of physical attractiveness for girls. These social norms may lead to greater use of restriction with girls.

In addition to learning food acceptance patterns, children are also learning a great deal about standards of beauty, and for women and girls in our culture, this standard includes thinness. Recent research indicates that, at least in the U.S. and England, by the age of 10 or so, children have learned to be concerned about their weight and how to diet (27,28,29). Recent surveys in the U.S. among 8- to 11-year-old girls reveal that among 8-year-olds, about a third thought they should be thinner, and slightly more than a third reported they had already tried to lose weight. By age 11, more than three fourths thought they should be thinner, and about two thirds of girls reported they had tried to lose weight (27,28,29). Recent evidence suggests that girls as young as 5 already have ideas about diets and dieting (30).

Conclusion

In conclusion, children “come equipped” with genetic predispositions to prefer and reject tastes, to be neophobic, and to learn to associate foods with the contexts and consequences of ingestion. Through early experience with food and eating, these predispositions are transformed into food preferences and styles of responding to cues in the food environment that shape the controls of food intake and food acceptance patterns. In recent years, there has been a dramatic increase in the prevalence of overweight and the emergence of dieting and weight concerns among young children, especially girls. Anticipatory guidance and prevention and treatment programs are needed to alleviate the problem of childhood overweight and the chronic health problems associated with overweight and obesity. Additional research is also needed to expand our knowledge of the etiology of the controls of food intake during childhood and to explore how these controls contribute to problems of energy balance and childhood overweight. However, given the increased prevalence of obesity and other problems of energy balance among children, including anorexia, bulimia and chronic dieting, there is a pressing need to begin to apply what is already known about the development of the controls of food intake in the first years of life. The present findings suggest approaches to developing preventive interventions and anticipatory guidance for parents. Promoting the development of food preferences that are more consistent with current dietary guidelines and good health will reduce the prevalence of childhood overweight.

Childhood obesity is a result of both genes and environment, and as a child develops, the family environment interacts with the child's genetic predispositions to produce a range of individual phenotypes. Across children during development, variations in both genotype and environment will produce individual differences in patterns of preference and intake, ranging from those consistent with adequate nutrition and health and normal weight status to those that result in problems of energy balance and overweight. While genetic factors undoubtedly play a central role in determining weight status, the recent increases in the prevalence of childhood obesity have occurred too rapidly to be attributed to genetic factors, therefore implicating environmental factors. Environmental solutions that address individual and family-level factors are an essential component of successful prevention and treatment of childhood overweight. However, a comprehensive solution to the problem must move beyond the individual and the family to address

the environment at all levels, including the social, cultural and economic factors that shape the larger context in which families are nurturing their children.

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Biography



Leann L. Birch

Dr. Leann Birch earned her Ph.D. in psychology from the University of Michigan. Dr. Birch has been Professor and Head of the Department of Human Development and Family Studies in the College of Health and Human Development at Penn State since 1992. Prior to that time, she was a faculty member at the University of Illinois. Her research interests are in the developing controls of food intake in young children, including the acquisition of food preferences and aversions, the development of individual differences in styles of intake control, and risk and protective factors for problems of energy balance. Her current funded research explores the antecedents of dieting in girls during middle childhood. Dr. Birch is internationally recognized for her work in this area, and is the author of more than 131 publications. She was recently awarded the American Institute of Nutrition's Lederle Award in Human Nutrition for her work.

