



---

## REVIEW ARTICLE

---

# *Development children's eating behavior*

Maurem Ramos,<sup>1</sup> Lilian M. Stein<sup>2</sup>

### Abstract

**Objectives:** review the literature, exploring factors that contribute to the development of children's eating behavior such as the role of learning and social context.

**Methods:** the review of the literature was done using Medline, Psyclit, and Lilacs as resources for assessing international and national research articles on child nutrition, with an emphasis on children's eating behavior. These articles were revised and grouped together according to the topic.

**Results:** family is responsible for the development of children's eating behavior through social learning. Parents are children's first nutritional educators. Children's eating experiences are influenced by cultural and psychosocial factors. Social context plays a relevant role in this process, especially through the strategies used by parents to encourage children to have a balanced diet and to eat specific foods. These strategies may contain adequate and inadequate stimuli as to the development of children's food preference and food intake self-control.

**Conclusion:** the learning process is a determining factor for children's eating behavior, and is associated with three factors: food flavor conditioning, food post-ingestional consequences, and social context. Parents are deeply concerned with the amount of food their children eat and not with the development of more adequate habits and attitudes related to dietary quality.

*J. pediatr. (Rio J.). 2000; 76 (Supl.3): S229-S237: eating behavior, children's nutrition, food preferences.*

### Introduction

Food intake is one of the contributing factors to the development of chronic degenerative diseases in humans. These diseases are today the main cause of death among

adults.<sup>1,2</sup> It is agreed that changes in eating habits are important to prevent food-related diseases and improve people's health. As eating habits are formed in childhood, it is necessary that their determining factors be understood in order to establish effective educational processes that can change children's eating behavior.<sup>3-5</sup>

---

1. Student, Graduate Program in Personality and Social Psychology, PUCRS.

2. Ph.D in Psychology, associate professor, Graduate Program, School of Psychology, PUCRS, Graduate Program in Personality and Social Psychology.

The literature on infant feeding shows that preschool children's eating behavior is firstly determined by their family and, in a second moment, by other psychosocial and cultural interactions. Preschool children's eating behavior is determined by food preferences. The difficulty lies in convincing children of the importance of a diversified diet, expanding their preferences and building healthier eating habits since many children are reluctant to try new foods and flavors. This phenomenon is called food neophobia.<sup>6-8</sup>

Food neophobia may be reduced by instructing children on hunger and satiation, edible substances, food tastes, as well as the amount of food that should be ingested.<sup>9,10</sup> This learning is of paramount importance to the development of children's eating behavior, which is established through a process of conditioning associated with sensorial food suggestion, post-ingestion consequences and social context.<sup>9</sup>

Psychosocially, eating behavior relies on parents' active participation as nutritional educators through family interactions that affect children's eating habits.<sup>11</sup> The strategies parents make use of at mealtime to teach children what and how much to eat play a vital role in the development of children's eating behavior.<sup>7</sup>

## 1. Concepts and Considerations on Children's Eating Behavior

Habit is defined as an act, use and custom or standardized reaction that originates from the frequent repetition of an activity (learning); this term may also be applied to behavioral standards as a generalization.<sup>12,13</sup>

This way, the foods or kind of foods that people habitually and repeatedly eat every day characterize their eating habits or behavior. However, the repeated ingestion of food alone does not form eating behavior. There is a series of interrelated factors, internal or external to the organism, which influences the formation of such a habit. It is important to say that eating habits are not necessarily synonymous with food preferences, that is, when people eat the foods they like best. However, in the specific case of preschool children, eating habits are basically characterized by their food preferences. Children in this age group end up eating just the foods they like, or which are available in their environment, refusing to eat those foods they do not like.<sup>7,8</sup> Among the interrelated factors present in the formation of eating behavior, the psychosocial factors stand out. These factors are responsible for the conveyance of food culture, and will be examined here in the view of family behavior.

Psychosocial factors influence food experience from childbirth, allowing the opportunity for initial learning about the sensation of hunger and satiation and also perception of different tastes. Adequate introduction of

new foods during the first year of life, and from this point on, by means of proper food socialization, and availability of a varied number of healthy foods in a pleasant environment, allow children to develop food preferences that will determine their pattern of consumption.<sup>7</sup>

Preschool children tend to have preferences that include foods with high concentration of carbohydrates, sugar, fat and salt, and low intake of foods such as vegetables and fruits if compared to the recommended amounts.<sup>14</sup> This tendency originates from children's food socialization and greatly depends on the patterns of the food culture to which they belong.

The cultural aspects may be summarized into the word "culinary", which refers to specific dishes and how these are prepared, involving ingredients, characteristic tastes and preparation. Culinary is concerned with the combination of foods or their processing at domestic and industrial level, adapting them in order to keep their nutritional value, and thus meeting people's biological and metabolic requirements.<sup>8</sup>

The selection of foods used in culinary varies according to different social classes, and is determined by rules with cultural and economic specificities of their own, represented in different ways. The psychological reasons for accepting or rejecting foods are included in these rules. Foods are categorized through sensorial suggestions (good taste, bad taste, or tasteless), consequences of eating certain foods (good, harmful), ideational factors (use of the food, adequate or inadequate, appearance, hygiene), which influence the selection of foods.<sup>15</sup>

Today, we are living in a modern food culture, where we find gastronomic intemperance and, at the same time, shortage of food, caused by social pressure or fashion, or economic restraint on the part of some social groups. This modern culture behavior may bring about nutritional deficiencies.<sup>16</sup> Although humans have a genetic predisposition for food selection, which is not fully understood until today, cultural power, conveyed through society and learned from initial food experiences, builds up every day.<sup>8,9</sup>

Food selection, amount of food, eating time, or in other words, nutritional rules are established by social groups. This way, we can offer children a programmed meal, determined by nutritional requirements, as well as feeding on demand, or both, depending on social occasion and dietary routine. In this case, children do not eat only because of hunger feeling but also by suggestion of the environment and social context, for instance, when playing with friends on a playground or at birthday parties.<sup>9,10</sup>

On the topic of psychosocial factors, family is responsible for the conveyance of food culture. Through socialization, children learn about the sensation of hunger and satiation, and develop their perception of taste and preferences, and

begin to form their eating behavior. Studies<sup>17,18</sup> on the conditioning of feeding showed that food preferences are basically formed by the association of three factors: (1) sensorial perception of foods, (2) food post-ingestion consequences ingesta and (3) social context.

## **2. Nutritional Learning Processes**

Physiological psychology has initially showed that internal suggestion of hunger and satiation were responsible for nutrition. At the same time, the homeostatic model, defined as internal physiological balance necessary for body maintenance appeared. In this model, eating is an unlearned response to hunger suggestion. However, this same model allows affirming that food intake can be learned. The role of learning in this model was only investigated in the 1950's or 1960's through a review of Pavlov's studies, carried out at the beginning of the century. Currently, studies on food experience and learning, nutritional standards and physiological responses interacting in the production of eating behavior.<sup>19</sup>

Studies<sup>20,21</sup> on food learning use the paradigm of food preference conditioning as standard procedure, based upon Pavlov's classic model. For example, a new taste used as conditioned stimulus is paired with a nutrient (unconditioned stimulus), which produces an effect (post-ingestion consequence) of satisfaction or aversion as unconditioned response. The conditioning results from the association of stimuli and unconditioned response through a training process.

Nutritional learning has presented some methods, based on the paradigm of conditioning, for expanding food preferences. These methods are: learning from repeated exposure and exposure, conditioned flavor/flavor preferences, and conditioned nutrient-flavor preferences.

### **2.1. Learning from Repeated Exposure or Exposure**

Acquaintance with food is the first step for children to learn about the taste of foods. Repeated exposure and/or exposure<sup>22</sup> are the process of acquaintance with foods. This process begins at weaning and with the introduction of solid foods during the first year of life. Children are gradually introduced to family food and parents have the duty of offering them a diversified diet so that they learn about different flavors, thus developing and testing their sense of taste. Although the sensorial qualities of breastmilk allow children to have their first contact with different flavors and smells, helping them to accept new foods during the weaning period, it is the learning through repeated exposure that provides the familiarity necessary for children to set up a pattern of food acceptance.<sup>23</sup>

In a study with preschool children on the extension of repeated exposure<sup>18</sup> to new foods/flavors, results showed that food cannot just be perceived visually or through the sense of smell; children need to taste the food, even in a small amount, so that conditioning is produced and food acceptance is enhanced. Usually, the acceptance of new foods occurs only after 12 to 15 presentations of food; parents could get discouraged, thinking their children do not like the food, and give up. However, repeated exposure may contribute to the reduction of food neophobia, a common characteristic in preschool children, that is, the fear of trying new foods/flavors.<sup>24</sup>

### **2.2. Conditioned Flavor/Flavor preferences**

Studies<sup>20</sup> with animals and humans have shown that by associating sugar or favorite flavor with an unknown or least preferred flavor, acceptance of the least preferred flavor is enhanced. Perception of flavors involves the sensation of sweet, salty, sour and bitter and some others associated with amino acids.

Sensitivity to sweet flavor is already present in the prenatal period, and is therefore an innate preference. Possibly, due to this sensitivity to sweet flavor stimulated by the chemical substances found in amniotic fluid during the prenatal period,<sup>25</sup> there is an increased acceptance of unknown foods when these are associated with sugar or with naturally sweetened foods.

In this kind of learning experience, flavor is associated to pleasure and, probably because of this, it is maintained with time, that is, it is long-lasting and can only be changed through another learning experience that replaces or neutralizes the previous one.<sup>20</sup>

### **2.3. Conditioned Nutrient/Flavor Preferences**

Conditioned nutrient/flavor or calorie/flavor preferences occurs in a way that is very similar to that of flavor/flavor experience. A nutritious substance with more calories causes a physiological feeling of satiation, which, associated with flavor, enhances the acceptance of unknown foods. As there is a delay between the sensorial suggestion perceived and the nutritional consequence, foods that have more calories are more easily accepted due to the increased feeling of satiation that occurs right after ingestion. In addition, foods with high fat content, which have more calories, usually are in the group of foods that are more frequently ingested and, consequently, more widely known. Foods with high fat content are also more palatable, since many volatile substances, which add flavor to foods, are fat-soluble. Furthermore, fat, as an ingredient for food preparation, adds a creamy and fluffy texture to foods, and probably

catches children's preference. Possibly because of physiological feelings of satiation and also flavor, the nutrient/flavor experience will develop a preference for calorie-rich foods.<sup>18,20</sup>

Capaldi<sup>20</sup> suggests that children should eat vegetables at the end of the meal due to the delay between nutritional consequence and sensorial suggestion of ingestion. This way, children can associate the flavor of vegetables to the satiation provided by calorie-rich foods eaten before the vegetables. However, this suggestion is set back by children's reduced appetite as a factor that affects food preferences. Nevertheless, reduced appetite does not affect the ingestion of desserts. Desserts, which are preferred by children due to their sweet flavor, are eaten at the end of the meal, associating the positive physiological consequence provided by the previously ingested meal and increasing preference. This explains why it is useless to force children into eating some kind of food they do not like at mealtime, using dessert as a reward.

Several experimental studies<sup>26,27</sup> were carried out with the aim of determining whether flavor preference can be conditioned in children between three and five years old through repeated association with high and low calorie density foods.

An experiment<sup>26</sup> using the nutrient/flavor learning experience was carried out with 11 children, male and female, at the average age of 49 months. In this experimental design, the calorie variable was manipulated for each subject. Each child was given a beverage with high calorie concentration, and another one with low calorie concentration. Carbohydrates were used for calorie differentiation. Each beverage contained new and distinct flavors. For the conditioning process, the beverages were given 4 days a week during a period of 5 weeks in a preset amount. Results showed that flavor preference conditioning may be based upon calorie post-ingestion, in this case, intake of carbohydrates. A clear preference for new flavors was observed when these flavors were paired up with the post-ingestion consequence of high-calorie beverages. Thus, the positive post-ingestion consequence of carbohydrates contributed to an increase in the consumption of new flavors, and consequently, in the reduction of food neophobia.

Another experiment,<sup>27</sup> similar to the previous one, attempted to determine whether infants aged on average 48 months develop flavor preference conditioned to fat content. This experiment also investigated whether the effect of fat content manipulation alters free-choice intake at subsequent meal. The authors concluded that infants develop preference for flavors that present different calorie content, produced by fat content. In 8 consumption tests, there was no change in the preference for new flavors when there was no increase in calorie content. On the other hand, data proved the existence of conditioned preference based upon calorie

content; these data were consistent with the experiment<sup>26</sup> previously discussed. The authors concluded that there is consistent evidence that infants can adjust their subsequent food intake in response to different calorie contents, as a result of the manipulation of test-beverage fat contents. In short, initial preference for new foods with high and low fat content may be learned; and conditioned preferences seem to be a result of post-ingestion consequence.

Associated learning, as well as the development of food preferences, is a central part for developing control over food intake, allowing to define or model what and how much infants ingest influenced by social context.

### 3. Social Context in Nutrition

Some studies<sup>9,28</sup> show the importance of social context in nutrition, as food experience influences eating behavior, infant socio-emotional development, and quality of parent-child relationship. The main focus of interaction between parents and children during the first years of life is usually nutrition, which begins with breast-feeding.

During breast-feeding, the reflection of orofacial expression is interpreted by parents as response to flavor preference or dislike, which allows a form of communication during the breast-feeding period. This period offers the opportunity for reciprocal learning about mother-child interaction, not only in terms of eating behavior, but also other kinds of behavior presented by infants.<sup>29</sup> In the second semester of life, with accelerated growth and development, infants need other foods besides breastmilk in order to meet their biological needs. The introduction of other foods changes their eating and infants have to learn about new flavors. This period is characterized by quick changes that end up causing most parents to feel anxious and stressed.

In the first years of life, infants begin to learn what and when to eat, why some substances are edible and others are not, and which flavors properly combine, according to the culture of the social group they belong to. Infants learn to like and dislike foods through repeated ingestion, associating food flavors with the emotional reaction of social context and physiological satisfaction of eating. Post-ingestion consequence is a predictor for acceptance when this consequence is positive, or aversion to foods when the consequence is negative.<sup>9,10</sup>

#### *Attitudes and Strategies in Nutritional Context*

Family mealtime is the social context in which infants have the opportunity for eating together with their brothers and sisters, friends and adults that are role-models to them,

and who are attentive to their eating behavior, complimenting, encouraging or calling their attention at the table. Some evidence<sup>18</sup> suggest that poorly palatable foods such as vegetables are offered in a negative context, usually involving coercion of infants into eating them. On the other hand, foods that are rich in sugar, fat and salt are offered in a positive context, enhancing the preference for these foods. Usually, these foods are offered at parties or celebrations, or as a reward if infants eat up their meal, in a positive interaction, making them a preference.

Positive interaction may give rise to negative interactions, in which parents make use of coercive strategies. As infants are forced into eating a certain kind of food, which parents believe to do them good, they reduce their preference for this food or flavor. External control is usually exerted in order that infants start to have a diversified diet and increased food intake, or to prevent infants from eating foods parents find inadequate. However, what infants learn from these interactions is not what parents had in mind. In these situations, infants learn to dislike the foods they are forced into eating, even if these are offered as a reward, which results in a contrary response. As a result, they may start to hate that kind of food. Reward and coercion are strategies normally used by parents as a way of instrumental nutrition.<sup>9,18</sup>

This instrumental characteristic of nutrition, as for example, "eat up your vegetables and then you can eat dessert", is a strategy that can systematically influence the development of food preferences and children's eating behavior itself. The use of reinforcement strategies by means of instrumental nutrition produces an immediate effect, although on the short run. However, on the long run, it produces a negative action on the preference of food intake. In these circumstances, the use of food as reward and a way to increase the intake of poorly palatable foods mixes up the functions of nutrition, thus contradicting the establishment of nutritional eating habits for children. These strategies end up causing adverse effects on the preference for some foods.<sup>17</sup>

Based on the fact that parents can directly influence the diet of normal and overweight children, a study using an etological method was conducted by the authors (BATMAN, Bob and Tom's Method of Assessing Nutrition) in the United States.<sup>30</sup> This study attempted to directly assess the effect of parent-child interaction on food intake by filming children aged 23.9 months on average in a natural environment at mealtime. These interactions were characterized by the verbal strategies used by parents during mealtime, and were categorized for the sake of analysis.

The results showed that mothers force children into eating more than fathers usually do. The category "encouragement to eat" with strategies that suggest, order and control children's food intake was strongly correlated with children's weight. The category "present foods", placing

food close to children, that is, showing food to children was not significantly correlated with children's weight.

The category "offer food", asking if children want some more food, for example "Do you want some more cake?", was moderately correlated with children's weight. These last two categories involve slightly forcing children into eating, whereas the category "encouragement to eat" is an order, for example "eat your food". According to authors, the intensity of nutritional induction is a better predictor of children's weight than the presence or absence of induction.

The study also showed that children with normal weight were not encouraged to eat or were not offered food, while children who were overweight were encouraged approximately 30 to 36 times to eat or were offered food during meals. Therefore, in general terms, the results showed the influence of the strategies used by parents to feed their children, which had an effect on the child's weight.

A similar investigation<sup>31</sup> was carried out in Swedish families, using the same method described above, adapted to that country's reality. The objective was to relate food intake in children between three and seven years of life with certain parental behaviors at mealtime, and also with parents' and children's weight.

The Swedish study revealed that family interaction, most of the mealtime, was characterized by general utterances (not food-related) and that children responded by eating and drinking. Data analysis showed a positive correlation between eating under parental command and energy intake, that is, the more parents urged children to eat, the more they ate. Certain negative utterances, however, presented negative correlations with children's eating behavior, without affecting energy intake.

The results also indicated that children with normal weight received more neutral food-related utterances than overweight children. Another observation indicated that children's food intake was correlated with their weight; thus overweight children tended to eat more if compared to those with normal weight. As far as parents' weight is concerned, a positive correlation was found only between mothers' weight and children's eating behavior.

In short, the data in this study showed that children's eating and drinking behaviors at mealtime are inversely related to parental negative utterances, indicating that, for this sample, parental behavior at mealtime may have had some kind of effect on children's food intake, but not on their energy balance, that is, amount of consumed energy. The authors concluded that the strategies used by Swedish families in comparison to those used by American families, presented by the previous study,<sup>30</sup> were different. This distinction may be observed, for instance, in the increased use and higher intensity of inductive strategies by American families than by the Swedish ones.

Another Swedish study<sup>6</sup> that investigated some determining factors in family's eating habits, pointed the use frequency of strategies for encouraging children to eat at mealtime. The three most commonly used strategies were "remind children of eating", "ask children to taste the food" and "praising children". A relation was observed between "children decide on their eating portion" and "postponing meals" with children's food neophobia, assessed by parents through a scale presented by interviewers. This result suggests that the more neophobic children are, that is, the more afraid of trying new foods they are, the most frequently parents will allow children to decide how much they want to eat, and then postpone meals to facilitate food intake. There was no difference in terms of gender and age as to the use of the strategies.

In a study<sup>32</sup> with Brazilian children between the ages of three and five, using a similar investigation procedure to that of the Swedish study, the authors analyzed, among other specific matters, the utterances parents used at mealtime to encourage their children to eat. The study also investigated the chemical composition of food intake. Parents' utterances were categorized according to a previously tested classification. In general, the results were similar to those obtained in the American and Swedish studies. However, children's food intake was inferior to the recommended allowances, although children's nutritional status was favorable; this led the authors to conclude that children compensated for their food intake with other meals during the day. This conclusion can also be corroborated through the data obtained by Birch et al.,<sup>33</sup> who proved that children have control over their daily food intake, based on their diet requirements.

In the Brazilian study on adults' utterances, the most frequent category (96%) was "giving orders", thereby parents tried to control their children's eating behavior using verbal orders, sometimes as a suggestion or request, as for instance "now two more forkfuls", "let me see the meat", and some other times incisively, demanding a certain kind of behavior as "come on, eat it!", "don't use your hand". Other utterances were grouped into less frequent categories, and encouraging or attention utterances were rare.

The authors concluded that children were actually engaged in eating their food at mealtime, although they had some other behaviors. Adults uttered a great deal of compelling statements; these adults served children a large portion of food or prepared their plates disregarding their opinion or view. Adults did not have exemplary eating behavior and were more concerned with making children eat, thus preventing them from forming their own eating habits, and becoming independent. The frequent utterances intended to facilitate food intake had a contrary effect to what was expected, favoring children's opposing or reluctant behavior.

### *Development of Hunger and Satiation Perception*

The eating strategies used by parents can also change children's internal control over hunger and satiation. There is some evidence<sup>9,17,28</sup> that the external control exerted by parents does not allow children to learn about hunger and satiation signs, affecting their own control over food intake, and resulting in weight problems. Children can learn how to distinguish between signs of hunger and other feelings, however, if parents offer them food when they are not hungry, they will probably have an inadequate diet. For example, when children say they do not want to eat on because they are satiated, and parents say "finish up your food", it is clear to children that their internal feeling of satiation is not relevant to the amount of food they need to ingest. Parents who externally influence their children's eating behavior may prevent the development of their adequate self-control. As a result, children may become dependent on external suggestion to start, proceed with and finish their meal.

In a study conducted by Birch et al.,<sup>33</sup> based on Clara Davis' classic study carried out more than 60 years ago, the total daily food intake of 15 children aged two to five was analyzed at every meal, during 6 days. Family foods were used in this study. These foods were organized into two menus, taking into account children's nutritional requirements. Children, however, were free to choose whatever they wanted to eat. The study revealed that children adjusted their total daily food intake at subsequent meals, which proves that there is a regulation between the size and interval of meals in childhood, as a result of food energy compensation and children's requirements. Parents' belief that children are unable to control their daily food intake, leads them to adopt measures that end up forcing children into eating more than what is necessary and eat food they parents find nutritious.

In terms of food selection, if parents let their children freely choose what to eat, without any previous selection, children will choose foods high in fat, sugar and salt, according to their previously mentioned food preferences. The study showed<sup>34</sup> that when children on average 5.3 years old could freely choose between nutritious and nonnutritious foods, they chose sugar-based foods, totalizing 25% of their caloric requirements. When children were told their parents would control their food intake, these children changed their eating behavior, reducing the intake of sugar-based foods. Mothers' control made children reduce their intake of nonnutritious foods. However, mothers were not concerned with replacing these less nutritious foods with more nutritious ones, which shows a concern with the quantity and not the quality of ingested food. In this study, there was no difference as to the selection of foods among obese and nonobese children, and mothers' obesity level was not associated with food selection.

Another experiment,<sup>17</sup> with children aged on average 49 months, analyzed whether social context can influence children's response to internal suggestion of hunger and satiation, as well as to the conditioning of the amount of food ingested at mealtime. Conditioning involved two different eating contexts. In one of these contexts, adults used strategies, that is, utterances that urged children to concentrate on their internal feeling of hunger and satiation. In this situation, adults verbally emphasized that these sensations of hunger and satiation during mealtime indicate when to eat, and when to stop eating. While children were eating, adults advised them to eat only until they were satiated. In the second eating context, adults used strategies that helped children to concentrate on external stimuli suggested by the environment, turning children's attention away from their internal sensation of hunger and satiation. The strategies used were reminding children of mealtime, using their favorite food as a way to make them eat the served portion, or drawing their attention to the amount of food on their plate. Other verbal strategies were used, as convincing children to eat and giving them a reward afterwards "you can eat your yoghurt now, and once you have finished, you may choose a toy from the box" or "you will get another prize if you eat more".

The results of this study revealed that eating social context may influence children's learning about their internal feelings of hunger and satiation. The data also indicated that children are responsive to caloric density, and that quantity may be conditioned when social context suggests self-control. In addition, the results showed that, as to the strategies centered around the internal feelings of hunger and satiation, children were spontaneously sensitive to caloric density and able to make associations with their internal feelings. On the other hand, children who were submitted to strategies that focused on external suggestions, were insensitive to caloric density. Within the context of internal suggestion, the size of the meal was strongly influenced by adults' utterances that urged children to eat in order to get a reward or because it was mealtime, or due to other strategies that turned children's attention away from their internal feelings of hunger and satiation.

It was observed that parents' strategies may change children's dietary self-regulation according to their nutritional requirements and that, probably, children's weight is also affected.

Another study<sup>35</sup> on nutritional strategies used by parents revealed the effect of family environment-related variables on children's weight and eating behavior; this study assessed 77 children on average 44.4 months old and their respective parents. The specific objectives were to investigate the relationship between (1) energy compensation rate and children's anthropometric measures, (2) weight status and parents' dietary (dietary restriction, nondieting control,

perception of hunger); (3) parents' and children's eating behavior; (4) strategies used by parents to control children's eating behavior and children's energy compensation rate. The results obtained with this study showed that, when parents have greater control over children's diet, these present less self-regulation in terms of energy intake. Children with high skinfold measurements were less responsive to food energy density. The relationship between failed energy intake self-regulation and increased body fat deposition was more evident in girls. The relationship between energy compensation rate and anthropometric measures was only significant to girls. Mothers' dietary control was negatively correlated with girls' energy compensation rate; the opposite occurred with boys.

This gender-related discrepancy may be attributed to different food socialization among girls and boys. Mothers' attempt to control and impose restrictions on their daughters' diet and not on their sons' due to social pressure (women are supposed to be lean), does not allow girls to learn how to regulate their energy intake by themselves. The results of this study also revealed a marked difference among parents' dietary history, which may influence children's eating behavior. Parents' lack of self-control in terms of food intake was strongly associated with their high level of adiposity, and at the same time, children's inadequate control over energy intake was associated with their high body fat content.

In short, parents' behavior may mold their children's eating behavior. The results suggest that mothers who rigidly control their own diet tend to adopt more demanding strategies; their children are less responsive to food energy intake, which results in children's gain of weight.

## Conclusions

The literature emphasizes the relevance of children's learning process to the formation of their eating behavior, through associated flavor conditioning, physiological response, and social context. The results of this study, focused on family's natural environment, corroborate those obtained with experimental lab research. Parents' strategies at mealtime contribute to children's acquisition of food preferences and internal control over hunger and satiation.

The influence of the strategies used by parents on children's eating behavior was also analyzed, and the results show that parents are deeply concerned with the amount of food their children eat and not with the development of more adequate habits and attitudes related to dietary quality.

The literature recommends that parents be well-informed on what a healthy diet for children consists of, and on what food preference conditioning methods are available, in order to diversify food options, thus reducing children's food neophobia. In addition, parents should be advised to allow their children to learn about their internal suggestion of hunger and satiation, develop their food intake self-control, and minimize overweight problems.

Although several researchers have recommended that the population should change their eating habits, the investigation into possible factors that interfere with the development of children's eating behavior is still rough in Brazil. It is crucial that the issue of children's eating behavior be understood and, if possible, dealt with in a multidisciplinary way. If that happens, we will be able to adopt measures and implement preventive programs based on Brazilian psychosocial and cultural reality, thus bringing an effective change in children's eating behavior and also promoting their health.

## References

- Drewnowski AP, Bary M. The nutrition transition: new trends in the global diet. *Nutr Rev* 1997;55:31-43.
- Scrimshaw NS. Nutrition: prospects for the 1990s. *An Rev Publ Health* 1990;11:53-68.
- Angelis, RC. Alimentação na infância vs conseqüências ulteriores na saúde. *Rev Paul Ped* 1995;13:126-7.
- Splett PL, Story M. Child nutrition: objectives for the decade. *J Am Diet Assoc* 1991;91:665-8.
- Winick M. The role of early nutrition in subsequent development and optimal future health. *Bull NY Acad Med* 1989;65:1020-5.
- Koivisto UK, Sjöden PO. Reasons for rejection of food items in swedish families with children aged 2-17. *Appetite* 1996;26:89-103.
- Birch LL. Psychological influences on the childhood diet. *J Nutr* 1998;128:407s-10s.
- Rozin P. Sociocultural influences on human food selection. In: Capaldi ED, ed.. *Why we eat what we eat. The psychology of eating*. 2nd ed. Washington: APA; 1997. p. 233-63.
- Birch LL, Fisher JA. The role of experience in the development of children's eating behavior. In: Capaldi ED, editor. *Why we eat what we eat. The psychology of eating*. 2nd ed. Washington: APA; 1997. p. 113-41.
- Rozin P. Development in the food domain. *Develop Psychol* 1990;26:455-562.
- Gillespie AH, Acterberg CL. Comparison of family interaction patterns related to food and nutrition. *J Am Diet Assoc* 1989;89:509-12.
- Ferreira ABH. *Minidicionário da Língua Portuguesa*. 3<sup>rd</sup> ed. Rio de Janeiro: Nova Fronteira; 1993.
- Cabral A, Nick E. *Dicionário Técnico de Psicologia*. São Paulo: Cultrix; 1974.
- Krebs-Smith SM, Cook DA, Subar AF, Cleveland L, Friday J, Kahle LL. Fruit and vegetable intakes of children and adolescents in the United States. *Arch Pediatr Adolesc Med* 1996;150:81-6.
- Fallon AE, Rozin P. The psychological bases of food rejections by humans. *Ecol Food Nutr* 1983;13:15-26.
- Freitas MCS. Educação nutricional: aspectos socioculturais. *Rev Nutr PUCCamp* 1997;10:45-9.
- Birch LL, Mcphee L, Shoba BC, Steinberg L, Krebbiel R. "Clean up your plate": effects of child feeding practices on the conditioning of meal size. *Lear Motiv* 1987;18:301-17.
- Birch LL. Children's preferences for high fat foods. *Nutr Rev* 1992;50:249-55.
- Capaldi E. Introduction. In: Capaldi ED, ed. *Why we eat what we eat. The psychology of eating*. 2nd ed. Washington: APA; 1997. p.3-9
- Capaldi E. Conditioned food preferences. In: Capaldi ED, editor. *Why we eat what we eat. The psychology of eating*. 2nd ed. Washington: APA; 1997. p. 53-80.
- Sclafani A. Conditioned food preference. *Bull Psych Soc* 1991;29:256-60.
- Sullivan SA, Birch LL. Pass the sugar, pass the salt: experience dictates preference. *Develop Psych* 1990;26:546-51.
- Sullivan SA, Birch LL. Infant dietary experience and acceptance of solid food. *Pediatrics*. 1994;93:271-77.
- Plinmer P, Loewen R. Temperament and food neophobia in children and their mothers. *Appetite* 1997;28:239-54.
- Beauchamp GK, Mennella JA. A alimentação nas primeiras etapas da vida e o desenvolvimento das preferências pelos sabores. In: *A alimentação na infância e suas conseqüências a longo prazo*. Nestlé Nutrition Services Resumo do 36<sup>o</sup> Seminário Nestlé Nutrition 1994; p. 27-9.
- Birch LL, Mcphee L, Steinberg L, Sullivan S. Conditioned flavor preferences in young children. *Physiol Behav* 1990; 47:501-5.
- Johnson SL, Mcphee L, Birch LL. Conditioned preferences: young children prefer flavors associated with high dietary fat. *Physiol Behav* 1991;50:1245-51.
- Birch LL. Development of food acceptance patterns. *Develop Psych* 1990;26:515-9.
- Blass EM. Suckling: determinants, changes, mechanisms, and lasting impressions. *Develop Psych* 1990;26:520-33.
- Klesges RC, Coates TJ, Brown G, Tillisch JS, Klesges LM, Holzer B, et al. Parental influence on children's eating behavior and relative weight. *J Appl Behav An* 1983;16:371-8.
- Koivisto UK, Fellenius J, Sjöden PO. Relations between parental mealtime practices and children's food intake. *Appetite* 1994;22:245-58.
- Brito MEF, Mettel MTP. Um estudo naturalístico do comportamento de pré-escolares durante a refeição. *Psicologia: Teoria e Pesquisa* 1986;2:1-13.
- Birch LL, Johnson SL, Andresen G, Peters JC, Schulte MC. The variability of young children's energy intake. *New Engl J Med* 1991;324:232-5.

34. Klesges RC, Stein RJ, Eck LH, Isbell TR, Klesges LM. Parental influence on food selection in young children and its relationships to childhood obesity. *Am J Clin Nutr* 1991;53:859-64.
35. Johnson SL, Birch LL. Parents' and children's adiposity and eating style. *Pediatrics* 1994;94:653-61.

Correspondence:

Dr. Lilian M. Stein, Av. Ipiranga, 6681  
CEP 90619-900 – Porto Alegre, RS, Brazil  
Phone/Fax: +55 51 3320.3633  
E-mail: lilian@pucls.br