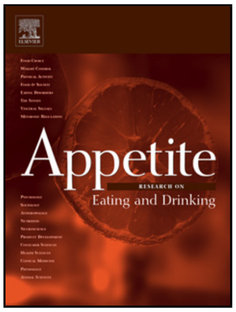
Accepted Manuscript



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Authors: T. Bettina Cornwell, Anna R. McAlister

PII: S0195-6663(11)00026-2
DOI: doi:10.1016/j.appet.2011.01.010
Reference: APPET 1141

To appear in:

Received date: 8-6-2010
Revised date: 2-12-2010
Accepted date: 8-1-2011

Please cite this article as: Cornwell, T. B., & McAlister, A. R., Alternative Thinking about Starting Points of Obesity: Development of Child Taste Preferences, *Appetite* (2010), doi:10.1016/j.appet.2011.01.010

Alternative Thinking about Starting Points of Obesity: Development of Child Taste Preferences

T. Bettina Cornwell [a]

Anna R. McAlister [b]

[a] Lundquist College of Business

University of Oregon

1208 University of Oregon

Eugene OR 97403

USA

tbc@uoregon.edu

[b] Department of Consumer Science

University of Wisconsin – Madison

1305 Linden Drive

Madison WI 53706

USA

armcalister@wisc.edu

Corresponding author: tbc@uoregon.edu (Bettina Cornwell)
Not for publication: Phone: +1 541 346 8241, Fax: +1 541 346 3341

Food marketers are at the epicenter of criticism for the unfolding obesity epidemic as societies consider banning advertising to children and taxing "junk" foods. While marketing's role in obesity is not well understood, there is clear evidence that children are regularly targeted with calorie-dense, nutrient-poor food. Much of the past research seeks to understand how marketing influences brand preference and child requests. The authors argue that understanding palate development offers new insights for discussion. Two studies consider whether a sugar/fat/salt (SFS) palate is linked to children's knowledge of food brands, experience with products, and advertising. In study 1, the authors develop a survey measure of taste preferences and find that a child's SFS palate (as reported by parents) relates significantly to children's self-reported food choices. Study 2 examines how knowledge of certain branded food and drinks is related to palate. Findings show that children with detailed mental representations of fast-food and soda brands - developed via advertising and experience - have higher scores on the SFS palate scale.

Keywords: fast-food, advertising, consumer behavior, public policy, children, preschool, obesity

Around the world, governments at various levels are considering legislation that targets obesogenic foods and environments. Of paramount concern is the trebling of obesity rates for preschoolers and quadrupling of obesity rates for children six to eleven years of age over the past 30 years (Institute of Medicine, 2006). Taxes on sugar-sweetened beverages (Brownell & Frieden, 2009), fast-food (Arnst, 2009), and salt (Wilson, 2004) have been proposed. Likewise, the redesign of food offerings in certain environments is under scrutiny, particularly in schools. Often targeted in this discussion are energy dense products high in sugar, fat, and salt and in particular, "fast-food" and soft drinks.

How is it that food and drink manufacturers and restaurant chains have come to offer so many products high in sugar, fat, and salt? One possible answer is that it has occurred in the pursuit of taste preference. Competitive market forces continually push companies to offer products that are preferred over others. In a 2004 study conducted for the U.S. Food and Drug Administration and the Department of Health and Human Services, a major barrier to food reformulation to meet societal weight management goals was consumer acceptance (Muth, Zorn, & Kosa, 2004). In the study, food manufacturers considered taste to be more important than calorie targets in product formulation and decisions were made with consumer acceptance in mind. In the same study, restaurant chains expressed that low calorie menus are challenging because fats and sugars contribute flavor to food and people want flavorful offerings. This discussion is consistent both with reports of failure of demand for healthy menu items (Grant, 2006) and with the expansion of "extreme" flavored foods (Liem & Mennella, 2003).

There appears to be a self-perpetuating cycle of consumer preference for sugar, fat, and salt, and manufacturer supply of foods that contribute to unhealthy eating habits. A review of the literature on development of food preference from 1999 found that “the ready availability of energy-dense foods, high in sugar, fat, and salt, provides an eating environment that fosters food preferences inconsistent with dietary guidelines” (Birch, 1999, p. 41). Recently, after reviewing the mixed results from school intervention programs to address obesity, Birch and Ventura (2009) argued “the most important limitation of school-based obesity prevention is the focus on school-aged children. By school entry, more than 20% of 2-5 year old children are already at risk for overweight…which suggests that a prime opportunity to prevent childhood obesity has been missed” (p. S75).

From a public health perspective, Drewnowski (1997, p. 249) has argued that “[n]utrition education and intervention strategies aimed at improving diet quality have focused almost exclusively on the nutritional quality of foods and not on the taste or pleasure response.” If taste preference is playing a role in the obesity epidemic, how can we identify a starting point for change? It seems that we must begin by addressing the development of palate and the preference for particular foods and thus, we must start with young children.

Development of Taste Preference

Our review of the literature across developmental psychology, pediatrics, nutrition, appetite, and public health resulted in twenty-seven papers addressing taste preference development among normally developing children. The literature addressing aversions, clinical issues in feeding, and neophobia as a phenomenon is larger. In normally developing children, it is well established that children prefer sweet and salty tastes (e.g., Beauchamp & Mennella, 2009; Harris, Thomas, & Booth, 1990; Nicklaus, Boggio, Chabanet, & Issanchou, 2004; Wardle & Cooke, 2008). Many of these same studies find that children dislike bitter and sour tastes but the findings, particularly regarding sour tastes, are mixed. Heightened preference for sour tastes has been documented for children aged 5 to 9 (Liem & Mennella, 2002, 2003) and sour preference has been documented with children as young as 18 months (Blossfeld et al., 2007). These basic tendencies, while complex and malleable, are influential because they are part of the reason why it is easy for children to come to like sweet and salty snacks and harder to gain acceptance by some for bitter vegetables or tart fruits.

Food acceptance is in part determined by genetics but taste preference is subsequently influenced by the history of one's exposure (Harris, 2008). Several acquisition processes have been researched as important to the development of food preferences. As mentioned, repeated exposure or "mere exposure" (Birch & Marlin, 1982) is one path to food preference. For example, Cooke (2007) - in a review of the role of food exposure to healthy eating patterns - summarized that children like what they know and eat what they like. Aspects of familiarity in terms of taste, context, visual recognition of the food, and familiarity with the food category are argued to play a role in dietary development (Aldridge, Dovey, & Halford, 2009). Another process important to the development of taste preference for foods is social learning and this has been researched extensively (e.g., Addessi, Galloway, Visalberghi, & Birch, 2005; Birch, 1980; Michela & Contento, 1986). For example, Addessi et al. (2005) showed that in young children, food acceptance is promoted by specific social influence (seeing an adult eat the same food). Lastly, and most related to marketing and policy, is the development of food preferences through associative learning (Birch, Zimmerman, & Hind, 1980). Young children associate foods with both the context and the consequences of eating. For example, eating in a restaurant with an indoor playground or selecting a food because of an enclosed toy may build brand-related food preferences through associative conditioning.

As a general animal phenomenon, flavor preferences retain plasticity throughout the lifespan because they respond to and are modified by experience, thus allowing adaptation to available food supply (Myers & Sclafani, 2006). The establishment of food preferences and habits in childhood influences food choice over the lifespan and has both short-term and long-term consequences for health (Kemm, 1987). For example, exposure to fruit and vegetables in the first two years of life results in greater dietary variety when children reach school age (Skinner et al., 2002b). Similarly, a population-based study from the UK found that dietary patterns of “junk” (burgers, pizza, fries, and sweets), “traditional” (meat and vegetables) and “health conscious” (vegetarian, grains, fruit) families at child age of four were still present when the child was seven (Northstone et al., 2005).

Many of the studies of child taste preference seek to understand how a palate for vegetables might be fostered. For example, Wardle, Herrera, Cooke, and Gibson (2003) report an intervention where children aged five to seven received exposure to raw red pepper and after eight days exhibited increased liking and consumption. Likewise, Skinner, Carruth, Bounds, and Ziegler (2002a) find that repeated opportunities to taste a food increase the chances of a child accepting or liking the food. The logic of repeated exposure as the key to preference also applies to fast-food, salty and sweet snacks, and sugar-added beverages. Moreover, the reinforcing nature of combinations such as sucrose and fat encourage avid consumption of high calorie foods (Naleid et al., 2008).

Marketing Communications' Potential Role in Palate Development

Across disciplines, marketing communications are implicated in poor nutrition and obesity. With a sense of deserved urgency, recent papers overwhelmingly address childhood obesity. In public health, there is concern that the foods advertised to children are predominantly fast-foods and sweets (83% according to Harrison and Marske, 2005). In medicine, television viewing and advertising to youth during viewing has been linked to caloric intake in the diet (Wiecha et al., 2006). Although some studies find little evidence is available to support claims that young children are particularly vulnerable to the effects of food advertising (Livingstone & Helsper, 2006), others are building evidence that links food marketing directly to consumption (Epstein et al., 2008; Halford et al., 2007; Halford et al., 2004). Importantly, food advertising exposure for children and adults can trigger automatic snacking of any available food (Harris, Bargh, & Brownell, 2009).

Public concern has resulted in industry self-regulatory attempts that have mixed results. For example, from 2003-2007, sugar-sweetened beverage advertising to young children decreased but fast-food advertising increased (Powell, Szczypka, & Chaloupka, 2010). Economic analysis by Chou, Rashad, and Grossman (2008) finds that banning fast-food restaurant advertising could reduce the number of overweight children and adolescents, but these data stem from the 1990s and do not consider the myriad of ways that food marketers now reach youth targets (see Harris, Brownell, & Bargh, 2009, for a review).

In considering the relationship between advertising and obesity, palate development has not been an underlying mechanism of interest. We define a pervasive palate preference to be one that influences food choices overall and in a variety of contexts. We argue that a pervasive palate preference may originate with particular foods and patterns of food exposure, but comes to influence food choice overall including decisions about new foods. Our thinking is that a pervasive palate preference may be altered via exposure patterns, or a cognizant will to change, but that once developed it serves as an unchecked guide in influencing food choice. This perspective helps to address inconclusive findings regarding advertising volume as a correlate of "junk food" consumption. Although not directly addressing palate formation, Schor and Ford (2007, p. 14) note, "if advertising shapes preferences early on, it can become a non-predictor in older children." That is, advertising exposure should not necessarily correlate with caloric intake after food preferences are established, even if it initially helped to form them.

We argue that exposure to energy dense foods such as fast-food and soda influences development of a pervasive pattern of consumption for the child. Evidence already exists to support this claim in a general way. Children receive marketing messages in many forms including advertising, promotion, in-store displays, trade characters, packaging--often with enclosed premiums such as toys (Harris, Pomeranz, Lobstein, & Brownell, 2009) and this continuous exposure builds knowledge of brand offerings. Marketing communications have been shown to not only influence food related behavior directly but to diffusely influence perceptions (Borzekowski & Robinson, 2001). For example, in a large survey, fast-food marketing exposure and access to fast-food outlets were related to parents' perceptions of social norms regarding the degree to which family, friends, and community members eat fast-food; this in turn influenced the degree to which parents provided fast-food to their children (Grier et al., 2007). Children are provided these foods or request these foods and frequently parents yield to requests (Bridges & Briesch, 2006; Donkin, Tilston, Neale, &

Gregson, 1992; Grossbart & Crosby, 1984; McDermott, O'Sullivan, Stead, & Hastings, 2006). In a qualitative study by O'Dougherty, Story, and Stang (2006), 63% of all parent-child negotiations in retail environments involved a child receiving a sweet food or snack.

Once adequate variety and repetition of exposure to foods high in sugar, fat, and salt (as typified in fast-food and carbonated and sugar-added beverages) is achieved, we argue that a generalized preference for these and similar foods is also achieved. In line with stimulus generalization theory (Houston, 1991), we expect children will develop a palate that favors foods rich in sugar, fat, and salt generally, irrespective of origin of this preference. As mentioned, this process of preference development has been studied extensively for foods (especially vegetables) where there is a desire to increase consumption (Birch, 1999), however, the process arguably applies to any food sampled frequently.

We argue that over time, a sugar, fat, and salt oriented palate results in a pervasive palate preference for heavily flavored foods, and that these foods are consumed for the purpose of achieving what is colloquially known as a "flavor-hit." While heavily flavored foods can sometimes be healthy, many are processed, flavor-added foods that contain excess sugar, fat, and salt or condiments that add sugar, fat, and salt to one's diet (such as ranch dressing). Although not directly studying palate, Northstone and colleagues (2005) found that a child's "junk food" dietary pattern, as opposed to "traditional" or "health conscious," was positively associated with being a "difficult eater." A detailed understanding of this finding is not provided but the results do allow an interpretation that junk food in the diet may change attitudes toward other foods. Specifically related to fast-food, the National Heart, Lung and Blood Institute Growth and Health Study found that, for girls aged nine to 19, fast-food intake is positively associated with intake of energy and sodium as well as total fat and saturated fat as a percentage of calories (Schmidt et al., 2005). In sum, food preferences with this background of marketing to encourage exposure and trial eventually manifest as patterns of consumption (Grier & Kumanyika, 2008) or habit. We return to the development of what we call "flavor hit" behaviors in study 2.

The purpose of the present research is, therefore, twofold. Ultimately we seek to assess antecedents of children's taste preferences. To achieve this goal, however, it is necessary to first establish a suitable measure of taste preference or "palate," thus our second goal is methodological in nature. Study 1 is used to develop a survey measure of taste preferences. It includes a pilot study to test the utility of an initial set of survey items, as well as its main study to test the reliability and content validity of a shortened survey. Study 2 then uses the established measure of palate; and examines the extent to which children's knowledge of food brands is related to their taste preferences.

Study 1: Development of a Survey Measure of Taste Preferences

In the literature on children's taste preferences, we find no existing general measure of taste preference for sugar, salt, and fat. At such a young age, a preschool child's food choices may be largely dictated by parents and caregivers. Although parents will ultimately decide which foods are purchased and in what quantity, children are known to influence parents' food purchase decisions (McNeal, 1992). Research to date has focused primarily on determining that children can detect slight changes in food taste (Crystal & Bernstein, 1998; Liem, Bogers, Dagnelie, & de Graf, 2006). Thus, we start by investigating whether preschool children have established taste preferences and subsequently we seek to understand if these guide other aspects of food choice.

Pilot Study

Item generation. To develop a survey measure of taste preferences, items were developed to assess the extent to which a child likes the tastes that typify the foods advertised directly to them, namely; those high in sugar, fat, and salt (see Harrison & Marske, 2005; Livingstone & Helsper, 2006). Given that the children of interest are "pre-readers" in most instances, this instrument was to be completed by a parent or guardian. In this pilot study, we assessed possible survey items for wording and their viability to contribute to a measure of taste preferences for sugar, fat, and salt.

Pilot study method. Three child experts (one developmental psychologist, and two in marketing), all trained in survey design, created a pool of 16 items to capture preference for sugar, fat, and salt. The pilot survey included five items measuring salt preference (e.g., "Child likes salty foods."), six items measuring a child's preference for sugar (e.g., "Child likes sugary dessert foods."), and five items measuring preference for fatty foods (e.g., "Child's favorite foods are typically high in fat."). An additional set of five items was included to measure general fussiness about eating while serving as distracter items. Finally, there were four items measuring behaviors related to flavorful food consumption (e.g., "Child adds extra flavor to food s/he is served (e.g., ketchup, gravy, spices)."), and an additional four distracter items relating to general activities that occur while eating. All 29 items were scored on a seven-point Likert scale, with some reverse scored.

Following Institutional Review Board approval for the project, 21 parents - each of whom had a child aged between three and five years - were recruited from a preschool where other unrelated research was being conducted. For this and the subsequent studies, participants were volunteers and were not compensated for their participation. All families were recruited from middle class preschools and gave consent to participate. Researchers working in preschools were trained in data collection methods used with children.

Pilot study findings. Comments from participants after they completed the survey indicated that item wording was appropriate for measurement of children's tastes and that the items covered a variety of contexts. Items pertaining to the three dimensions believed to measure sugar, fat, and salt (SFS) palate preferences were subjected to an exploratory factor analysis. Using maximum likelihood extraction and oblique rotation (to allow for potential correlation between the factors), factors were identified using a cutoff criterion of eigenvalues greater than one, as well as scree plot examination. The analysis yielded five factors with eigenvalues greater than one. Examination of the scree plot showed that the first two factors were more distinct than the remaining three. The first factor was interpreted as indicating a child's preference for SFS tastes. This SFS factor comprised 12 of the 16 sugar, fat, and salt preference items. The second meaningful factor was represented by three reverse-scored items that were intended to measure sugar and salt dislike, but instead appeared to load onto a factor measuring food fussiness and complaining behavior. The remaining three factors were unintelligible and emerged as a result of cross-loadings. On the basis of these findings, the 12 items loading on factor one (α = .85) were retained for use in study 1 (all of these items are discussed further in study 1 and are detailed in a subsequent table). In addition to the 12 SFS items retained, four exploratory items measuring behaviors related to flavorful food consumption were retained, along with five of the fussiness items which continued to serve as distracters in study 1.

Study 1: SFS Internal Consistency and Validity

This study aims to determine the internal consistency of the revised SFS scale and to assess the validity of the measure by testing correlations between parent reports of children's taste preferences and children's self-reported taste preferences. It was anticipated that where a parent indicated that their child's palate favors foods high in sugar, fat, and salt, the child would report a greater liking of flavor-added foods (high in sugar, fat, and salt) over natural foods (i.e., those which may be flavorful in their own way, but are not flavor-enhanced).

Study 1H1: The palate survey will show good construct validity. Parental ratings of child SFS palate will show significant positive correlations with children's self-rated preference for flavor-added foods.

We also expect to find that children generally show a strong liking for foods high in sugar, fat, and salt (i.e., flavor-added foods). Hence, we anticipate that children's self-reported taste preferences will favor flavor-added foods:

Study 1 H2: Children will report a significantly greater liking of flavor-added foods compared to natural foods.

Lastly, we pilot test a four-item measure of children's behaviors regarding heavily flavored food (e.g., "Child eats intensely flavored foods like Cheetos and Doritos") and a child's behavior to achieve more flavor in foods (e.g., "Child adds extra flavor to food s/he is served (e.g., ketchup, gravy, spices)"). Our interest was to develop a measure for use in study 2 that would capture a child's active choices toward or against additional or intense flavor in foods since these types of foods are frequently targeted to children (Liem & Mennella, 2003).

Study 1 method. Participants were recruited from a middleclass preschool in a large metropolitan city. They included 67 children (31 boys, 36 girls) aged 3y10m to 5y8m (*M* = 4y8m, *SD* = 7m) and their mothers. While fathers and guardians would have been welcomed as participants in this and study 2, none elected to be the primary respondent for the family. No child had any known or suspected developmental disorder and all children spoke English as their first language. Two children were Asian and the remaining participants were Caucasian. The mothers were aged 25 to 46 years (*M* = 33.25, *SD* = 3.42). Most mothers had commenced but not completed university studies (64%), some had undergraduate degrees (31%), while the remainder had not studied beyond high school (5%). Each mother reported on her child's taste preferences and food choices by completing the revised 21-item survey with distracter items as used in the pilot study (see Table 1 for items used to measure taste preferences and behaviors related to flavorful food consumption).

Children participated in a food "tastiness" task that required them to indicate their response to stimulus pictures by pointing to options on a five-point scale ranging from big frown (really dislike the taste) to big smile (really like the taste). The stimulus foods included 11 natural foods and 11 flavor-added foods, each depicted in color without any packaging. These foods were chosen to represent a variety of common fruits, vegetables, and dairy products thereby allowing for assessment of a range of tastes. The foods were, to the extent possible, matched for similarity or essence to reduce the likelihood that children's average liking of natural versus flavor-added foods would be affected by the chosen stimuli. For example, water and cola are both common drinks that are highly familiar to children. Strawberries and strawberry-flavored ice-cream both taste like strawberry and are similar in color. So, for example, if a young boy chose to avoid pink foods because they are "girly" then we could expect his dislike of pink foods to impact his rating of both the natural and flavor-added strawberry stimuli. Similarly, if a child likes to play with small foods, this fondness should impact jellybeans as well as green beans that may be popped open to reveal the smaller beans inside. Despite this matching, children were not required to make direct comparisons within the pairs of natural and flavor-added foods. Instead, children were shown the 22 pictures one at a time (in random order) and asked if they had ever tasted the food and, if so, were then asked to rate its taste. This task, while specifically developed for use with young children, is not unlike the established knowledge and preference scale developed by Calfas, Sallis, and Nader (1991) for four- to eight-year-olds and the modified scale by Kopelman, Roberts, and Adab (2007) for nine- to eleven-year-olds. For example, Kopelman et al. (2007) had children choose between an apple and a fruity lollipop, whereas our task reduces complexity by simply asking children to provide one taste rating for each individual food. Each of the 67 children participated in an individual session lasting roughly 15 minutes. Parent data collection immediately followed the conclusion of child testing.

Insert Table 1 about here

Study 1 results and discussion. Data from parent responses to the survey items measuring children's taste preferences and food consumption behavior were subjected to an exploratory factor analysis using maximum likelihood extraction (fussiness items were excluded since they were distracter items only and not central to the research purpose). Direct oblimin oblique rotation was used to allow for correlated factors. To determine the number of factors to be interpreted, we considered both the Kaiser criterion (i.e., interpret all factors with eigenvalues greater than one) as well as the Scree test (i.e., interpret all factors that occur prior to the last major drop in eigenvalue magnitude, as indicated on the scree plot). The results showed three factors. The first factor included all but one of the SFS taste preference items, while the second factor comprised the four survey items measuring behaviors related to flavor seeking food choices. The third factor consisted of cross-loadings and was represented by a single SFS item and other reverse worded items. Hence, the item “Child sometimes complains that food is too greasy” was disregarded and the analysis was re-run to examine the behavior of items with this problematic item removed.

The results of the final factor analysis are displayed in Table 1. The output showed two clear factors (eigenvalues of 7.40 and 2.89, respectively) and one partially distinct factor (eigenvalue of 1.01, but no distinctive standing in the scree plot). Consistent with Brown (2006), factor loadings were interpreted from the pattern matrix. As seen in the prior analysis, the first factor comprised the SFS items. This scale was subsequently labeled “SFS palate” ($\alpha = .96$). The four items measuring behaviors related to flavorful food choices comprised the second factor, which was subsequently labeled “flavor-hit behaviors” ($\alpha = .96$). This second scale will be used in study 2. Finally, the third factor consisted of cross-loadings. Each item’s cross-loading on factor three was small compared to its primary loading (on either factor one or factor two), however, the two largest cross-loadings are noteworthy. Specifically, items 16 and 19 had cross-loadings above .30. Given that each of these items is reverse-worded, it appears that the partially distinct third factor is best interpreted as a representation of the impact of item wording.

The results of this analysis indicate that the 21-item survey provides an internally consistent measure of children’s taste preferences (SFS palate) as well as an internally consistent measure of flavor-hit behaviors. Consistent with suggestions in the prior literature, parents report that their children tend to like foods high in sugar, fat, and salt (SFS palate mean score = 4.92, *SD* = 1.57). No ceiling or floor effects are present, since SFS palate scores spanned a wide range (range: 1.42 to 6.67). Flavor-hit behavior scores were also variable (range: 1.00 to 7.00, *M* = 5.08, *SD* = 1.43). These scales were correlated ($r = .37$, $p < .01$), indicating that children whose palate favors sugar, fat, and salt also orient to "flavor-hit" foods. Although SFS palate and flavor-hit behaviors are clearly related, it is important to note that these emerged as separate factors and that cross-loadings were low.

To assess hypotheses 1 and 2, data obtained from children's self-reported food choices were examined. Table 2 shows the average ratings of tastiness reported by children in relation to each food. Note that there is good variance on most foods, with a full range of perceived tastiness scores from one to five. Exceptions were strawberry ice-cream, ketchup, and fruit flavored cereal (which ranged two to five), and jellybeans which were liked by all children (range of four to five only).

Two separate factor analyses were conducted, one for natural foods and one for flavor-added foods. A single factor analysis was not possible due to missing data. While each child had tried most foods, at this age, there were still foods that some children had not experienced. Seven natural foods (apples, bananas, (plain) milk, fruit salad, water, green beans, and tomatoes) were found to comprise an internally consistent scale of children's liking of the taste of natural foods ($\alpha = .88$, range: 1.17 to 4.71). Children's liking of the taste of flavor-added foods was similarly well represented by eight of the foods from this category (cheese puffs, corn chips, watermelon hard candy, jellybeans, banana soft candy, ketchup, cola beverage, and chocolate milk) ($\alpha = .84$, range: 2.00 to 5.00). These scales are negatively correlated ($r = -.69$, $p = .000$). Interestingly, in both analyses, several dairy foods tended to form separate factors or showed high cross-loadings. The average sugar, fat, and salt content for the natural foods was 9.46g, 0.82g, and 21.5mg, and for flavor-added foods: 17.51g, 3.59g, and 101.20mg respectively. These averages were computed based on recommended serving sizes (nutritiondata.com; thedailyplate.com).

Using these scales of preferences for the tastes of natural and flavor-added foods, we assessed the validity of the SFS palate scale by comparing parent survey responses with children's self-reported preferences. Convergence was high. Where a mother indicated that her child's palate favored foods high in sugar, fat, and salt, the child tended to report a high liking of flavor-added foods ($r = .86$, $p < .001$). Moreover, there was a strong negative correlation between SFS palate and children's liking of natural foods ($r = -.72$, $p < .001$). Hypothesis 1 is supported. These findings are open to interpretation. A causal relationship would argue that those with a strong SFS palate lose interest in natural food as a result of their palate orientation. With these young children, however, it may simply be that their recent experience of food exposures results in current preferences that might be shifted by alternative exposures.

Hypothesis 2 was investigated by comparing children's self-reported liking of flavor-added foods with their average liking score for natural foods. Support was found for the hypothesis. On average, children reported a greater liking for the taste of flavor-added foods ($M = 4.25$, $SD = .90$) compared to the taste of natural foods ($M = 3.12$, $SD = 1.02$), $t = 6.72$, $p < .001$. Keeping in mind that the high average liking of the taste of flavor-added foods is not indicative of ceiling effects (i.e., not all children report a strong preference for the taste of flavor-added foods), this result begs the question of why some children show a strong liking for the taste of flavor-added foods while others do not. This finding is unlikely attributable to the stimulus materials, since natural and flavor-added foods were equally colorful in presentation and were similarly depicted without packaging. Study 1 lends support to the usefulness of the SFS palate measure by showing a high correlation with children's self-reported food taste preferences. Study 2 addresses some of the potential factors leading to development of a SFS palate.

Study 2: Development of Brand Knowledge and Links to SFS Palate

Ubiquitous to discussions of diet, and in particular child diet, are fast-foods and sugar-sweetened beverages. Sugared beverages have been called the "single largest driver of the obesity epidemic" (Brownell & Frieden, 2009). Compelling evidence finds that sugar-sweetened drink consumption is a contributor to school age child obesity (Ludwig, Peterson, & Gortmaker, 2001); further, it has been noted by researchers that it may also be a marker for other factors that influence body weight. For example, Linardakis et al. (2008) found that, for Greek children aged four to seven, high consumers of sugar-added beverages consumed significantly less calcium, Vitamins A and E, fruit and vegetables, milk, and yogurt. Moreover, these same high consumers of sugar-added beverages also consumed more sugar not contained in beverages as well as more sweet and/or savory snacks. A possible explanation for this finding is that families that regularly consume sugar-added beverages also regularly consume sweet and savory snacks. Another explanation, one that is particularly compelling with the development of preference by young children, is that the palate that is developed with sugar-added beverages also favors the consumption of sweet and savory snacks (and potentially other foods high in sugar, fat, and salt).

Fast-food is arguably another powerful harbinger of palate development. In the postnatal environment, children's taste preferences are led by the aesthetic appeal of foods, the emotional context of consumption, and other environmental variables (Benton, 2004), thus, positive associations with popular fast-food and soda brands are expected to lead children to develop a preference for energy-dense foods similar to those offered by the popular brands. Evidence from experimental research has also shown that children's perception of taste is affected by food branding. In a study of 63 children aged three years six months to five years five months, researchers asked children to taste pairs of food items and report whether the foods tasted the same or if one tasted better. In each trial, the paired foods were identical except that one option was wrapped in McDonald's packaging and the other was wrapped in unbranded packaging. In relation to four of the five foods studied (McDonald's nuggets and fries, and carrots and milk purchased at a local store), children reported that the food tasted better when wrapped in McDonald's packaging (Robinson, Borzekowski, Matheson, & Kraemer, 2007). These findings clearly indicate that food branding influences children's taste perceptions. What is not clear from the results, however, is whether children's experience with fast-food brands results in the development of a palate that favors energy-dense, high sodium foods typical of most fast-food outlets. In the current research, children with greater knowledge of fast-food and soda brands are expected to have a higher preference for foods high in sugar, fat, and salt:

Study 2 H1: There will be a significant positive relationship between fast-food and soda brand knowledge and children's SFS palate.

How then is a child's brand knowledge developed? Literatures across disciplines are replete with arguments regarding the role of advertising in the rising obesity epidemic.

Harris, Pomeranz, et al. (2009) review international research that considers food marketing to children and conclude that "marketing affects what children eat by increasing their awareness of, desire for, and intention to buy the products promoted" (p. 221). Since most foods advertised during children's television time are for foods high in sugar, fat, and salt (Harrison & Marske, 2005), we expect that children who spend more time watching television will have greater knowledge of brands offering foods high in sugar, fat, and salt. This would therefore include fast-food and soda:

Study 2 H2: There will be a significant positive relationship between frequency of television viewing and children's fast-food and soda brand knowledge.

Naturally, exposure to fast-food and soda via consumption occasions should also contribute to brand knowledge. Communication repetition and the spacing of messages have been shown to support memory for advertising (Janiszewski, Noel, & Sawyer, 2003), as has message variation in advertising (Singh, Linville, & Sukhdial, 1995). For brand knowledge acquisition, regular visits to fast-food outlets offer spacing of exposure, repetition and variation as children see venues, packaging, trade characters, and logos, and experience the products.

Study 2 H3: There will be a significant positive relationship between frequency of fast-food consumption and children's fast-food and soda brand knowledge.

One of the few longitudinal studies of child dietary intake found that dietary energy density at age five is similar at age seven and that an energy dense diet at age seven is associated with fatness at age nine (Johnson et al., 2008). The authors conclude that dietary habits are established early in life. Thus, it is anticipated that product exposure and consumption will influence general preference for foods high in sugar, fat, and salt in preschool aged children. Hence, frequency of fast-food consumption is expected influence children's SFS palate directly.

Study 2 H4: There will be a significant positive relationship between frequency of fast-food consumption and children's SFS palate.

Finally, in a study of child food preferences one must consider the influence of parents. Even though it might be expected that parental food preferences largely determine child preferences, findings are mixed. In a meta-analysis of the relationship between parent and child food preference, Borah-Giddens and Falciglia (1993) found that similarity in food preferences is of small significance in predicting child food preferences. Subsequent studies have found particular preference formation guided by mothers in terms of vegetable consumption (Skinner et al., 2002b) and in a longitudinal study these authors found general but moderate correlation between mother and child preference (Skinner et al., 2002a). In a study of child-parent pairs, Guiddetti and Cavazza (2008) found that children aged ten to 20 explore and possibly reproduce parents' preferences more than parents' avoidances. Importantly for the current research, children at a young age (three to four years) are decidedly influenced by the physical and social environment (Rolls, Engell, & Birch, 2000) and important to their preference development is the occasion of exposure to food. This discussion leads to two hypotheses, one where the parent's palate has a direct influence on the child's palate and another where the parent's palate guides the decision to afford the child fast-food consumption.

Study 2 H5: There will be a significant positive relationship between parent SFS palate and children's SFS palate.

Study 2 H6: There will be a significant positive relationship between parent SFS palate and child's frequency of fast-food consumption.

These relationships are represented in the Figure 1 model. Also depicted in the model is children's "flavor-hit" behavior, since study 1 revealed a correlation between SFS palate and child food preferences. To extend examination of child food preferences, and to consider behavioral tendencies regarding foods, we consider behaviors that satisfy "flavor-hit" seeking (or avoid it). Finally, the model considers the contribution of verbal mental age to brand knowledge. Between ages three and five, children have the capacity to rapidly acquire knowledge and this capacity should be a natural contributor to knowledge in general as well as to specific areas of knowledge such as brand knowledge.

Study 2 Method

The same 21-item taste preference survey is employed here. Although study 1 results showed that one taste item contributed poorly to the SFS scale, an identical survey was administered in this second study to see if items loaded similarly onto factors when data were obtained from a new sample. The participants in this study were 108 children (54 boys, 54 girls) aged 3y0m to 5y6m (M = 4y4m, SD = 7m). These children were recruited from five different preschools that are relatively close in geographic location (clustered around the one metropolitan area), and are lower-middle to upper-middle class. All children spoke English as their first language and none had any suspected or diagnosed developmental disorder. No child was color-blind (which may have impacted performance on the brand knowledge task). Most children were Caucasian, while six were from various minorities. One parent of each child (all mothers) also participated by completing a brief demographic survey, which included items about television viewing and fast-food consumption. Following a reminder letter to increase return of consent forms and surveys, the response rates across preschools ranged from 80% to 87% (M = 83.51%).

Data from the different testing sites were pooled after analyses showed no significant differences with respect to environmental influences relevant to this study. Specifically, an ANOVA used to compare across the five preschool groups showed no significant difference in the average frequency of fast-food consumption, $F(4,103) = 1.32$, *ns*. Likewise, the difference between frequency of unsupervised television viewing was not significant when comparing across children recruited from different preschools, $F(4,103) = 2.13$, *ns*.

Two to three staff members from each preschool also participated by completing the taste preference survey in relation to the children under their care (each staff member reported on roughly ten children). The same 21 items from study 1 were again employed, with seven-point Likert scale response options. In the present study, caregivers completed the survey so that survey utility could be tested with respondents other than parents, and also to determine whether social desirability effects might have affected mothers' responses in study 1. The caregivers had sufficient knowledge of each child's taste preferences since the children ate at least two meals per day at the preschools.

In order to quantify how much information a child has processed and stored about food brands, we utilized a recently developed "brand representation task" by McAlister and Cornwell (2010). While collage-type tasks have been used to assess constructs such as materialism in children and adolescents (Chaplin & John, 2005, 2007), across marketing, psychology, sociology and health literatures, this was the only brand knowledge task for children this age that could be identified. The task requires children to sort picture cards to create collages reflecting their knowledge about brands. While the original instrument was long and included six collage tasks—each with two competing brands (for foods, drinks, toys, entertainment, and cars), only two were relevant to the current study: fast-food and soda brands, namely: McDonald's, Burger King, Coca-Cola, and Pepsi. Successful task performance requires that a child correctly identify items belonging to a brand thus capturing brand awareness through a recognition measure (Keller, 1993), distinguish one brand's offerings from those of a competitor thus capturing unique associations that communicate brand differentiation (Keller, 1993), and disregard irrelevant distracter items (e.g., swimming goggles do not belong with either fast-food or soda brand). For each of the brands, color pictures are presented on 3 x 3.5 in. cards. As in McAlister and Cornwell's (2010) research, six pictures are used for each brand: three products, two sales/purchase venues, and one "other" card depicting a trade character or merchandise item.

Each brand pair (fast-food pair and soda pair) is assessed on a separate trial. For each of the two trials, the researcher lays out three pages in front of the child. The child is presented with 18 randomly sorted stimulus cards (six per brand, plus six distracter cards depicting irrelevant products and venues). The researcher commences by sticking the logo of one brand on the first page and the logo of the competing brand on the second page, and saying: "We're going to make some pictures. I want you to show me how to make these pictures. This one is the [Coke] picture, so you should put all the [Coke] ones here. This one is the [Pepsi] picture, so put all the [Pepsi] ones here. This one is for any that don't belong (*demonstrating with additional distracter card*)." The order of presentation of brand pairs is counterbalanced across participants. Collages are photographed for later coding. Three scores are calculated for each trial; one for each collage. One point is awarded for each correctly placed item (each collage score could range from zero to six). The incorrect placement of any card is not penalized. Due to the dependent probabilities of scores across collages within a trial, all three collage scores are needed to assess the accuracy of distinctions made on each trial. To capture this information, trial scores are calculated by summing across the three collage scores. Trial scores could potentially range from zero to 18.

Although the collage task measures brand knowledge with minimal verbal requirements, receptive language skills are needed in order for the child to understand verbal instructions given by the researcher. Moreover, one might argue that receptive vocabulary is needed in order for a child to process advertising messages that help to shape their brand knowledge. Hence, receptive vocabulary was measured using a standardized test (PPVT IV: Dunn & Dunn, 2007). On each page of the test book, children see four pictures. In this test, the researcher says a word and the child is required to point to the correct picture. Pictures are presented in sets that increase in difficulty. Testing continues until a pre-specified number of items in a set are missed. PPVT IV test scores were converted to standard verbal mental age scores (VMA) according to guidelines set out in the test manual.

Brand knowledge and receptive vocabulary data were collected in two individual sessions with each child that were undertaken on separate days. Receptive vocabulary sessions varied depending on the child’s age, with older children taking up to 15 minutes. The brand knowledge task required an average of 20 minutes and tended to vary with the child’s voluntary verbalization regarding their experiences with the brands and distracter items. It should be noted that all children recognized the brand logos for all stimulus brands. All sessions with the 108 children were completed within four months. Caregiver and parent data collection immediately followed the conclusion of child testing. Frequency measures of TV viewing (number of hours unsupervised viewing) and fast-food consumption (number of times eating fast-food in a typical week) were captured with single concrete items (Bergkvist & Rossiter, 2007). Parent SFS palate was measured using Likert-scale survey items similar to those developed in study 1, but with wording adapted for adults to self-report.

Study 2 Results

The caregiver survey data were subjected to factor analysis as per study 1. Again, the same two meaningful factors emerged and the same single survey item was discarded for loading alone onto a third factor. SFS palate was constructed using 11 survey items found to represent one single factor ($\alpha = .94$), and "flavor-hit behavior" was represented by four items pertaining to consumption of heavily flavored foods ($\alpha = .92$). Consistent with the results of study 1, flavor-hit behavior scores were variable (range: 1.00 to 7.00, $M = 4.58$, $SD = 1.67$) and there were no ceiling or floor effects in the SFS palate scale (range: 1.64 to 6.55, $M = 4.36$, $SD = 1.33$). Again, these scales are significantly correlated ($r = .29$, $p < .01$).

The consistency of findings across studies 1 and 2, using different samples of parents (study 1) and caregivers (study 2) supports the utility of the survey. Further evidence of this is seen from the fact that the average SFS palate score reported by mothers in study 1 ($M = 4.92$, $SD = 1.57$) did not differ significantly from the average SFS palate score reported by caregivers for a separate sample of children in study 2 ($M = 4.36$, $SD = 1.33$), $t = 1.20$, $p = .11$. This comparability in scores may be attributable to the reverse coding of several survey items and the inclusion of filler items to distract from the focus of the survey.

The collage task used to assess brand knowledge was successful in terms of yielding variance in children's representation of fast-food (range: 2 - 18) and soda (range: 3 - 18) brands. Although trial scores could potentially range from zero to 18, it is not at all surprising that no child scored zero. Zero-level performance would require a child to place every picture card inappropriately on the sheets (i.e., it would require performance well and truly below chance). Performance on the two trials was correlated ($r = .60$, $p = .000$), suggesting that the two trials can be used together to give an overall indication of children's knowledge of SFS food brands.

Data were next analyzed using structural equation modeling with the latent variable, brand knowledge, captured via measures of children's representation of soda and fast-food brands. SFS palate was represented by the single scale measure that had been calculated by averaging across the 11 survey items shown to represent the construct. This single indicator was used rather than the 11 individual items to increase the ratio of cases to model parameters. The scale has excellent internal consistency and the Guttman Split-Half coefficient is also good (.87).

Flavor-hit behavior was included in the model as a behavioral outcome emerging as a result of palate development. Due to specification issues arising with the flavor-hit items; the model was re-specified to include only three flavor-hit behavior items. While all items contributed similarly to the scale of flavor-hit behavior, the item "Child eats intensely flavored foods like Cheetos and Doritos" was selected for deletion because it is less general than the three remaining items. The full model is depicted in Figure 1.

Note that our sample of 108 cases is sufficient for testing this model. While a "typical" sample size in studies using structural equation modeling is about 200 cases (Breckler, 1990), smaller samples are considered acceptable when the estimation method used is maximum likelihood and the number of cases to parameters estimated is sufficient (Jackson, 2003). Bentler and Chou (1987) indicate that a ratio of 10 responses per free parameter is sufficient to obtain trustworthy estimates. Kline (2011) notes that structural equation models with less than 100 cases may be untenable, however, for simple models a sample of 100 may be appropriate.

Insert Figure 1 about here

As would be expected in a situation of good model fit, estimation of the full model produced a non-significant chi-square ($\chi^2 = 32.938$, $df = 29$, $p = .280$). Other fit measures also provide evidence of good model fit to the sample data (RMSEA = .036 with confidence intervals from .000 to .085; CFI = .987). These indicators are consistent with Kline's (2011) description of a good model being one that has a non-significant chi-square (i.e., p should be *greater than* .05), as well as a RMSEA below .05 and a CFI $\geq .95$. While Kline (2011) warns against the interpretation of a normed chi-square, others such as Ullman (2001) argue that this measure indicates good model fit when it falls below 2. In our model, the normed $\chi^2 = 1.136$, and thus falls well within acceptable range for readers who regard this as an important indicator of model fit. The Normed Fit Index (NFI) is an additional measure that is thought to indicate acceptable model fit when it is found to exceed .90 (Byrne, 1994). In our model, this requirement is met with an NFI of .910. The Jöreskog & Sörbom Goodness of Fit Index (GFI) is another popular indicator of model fit. It, however, is not included here since AMOS does not calculate GFI for models that estimate means. Standardized regression weights for each of the paths are depicted in Figure 1.

Although not a hypothesis of interest, the expected contribution of a child's verbal mental age to their brand knowledge was positive and significant ($\beta = .32$, $p < .01$). Children with more advanced receptive vocabulary were more knowledgeable of fast-food and soda brands. Considering hypotheses 2 and 3 first, we find that both television viewing ($\beta = .26$, $p < .01$) and frequency of child fast-food consumption ($\beta = .30$, $p < .01$) contribute to child brand knowledge. Moreover, frequency of child fast-food consumption is significantly predicted by parent SFS palate ($\beta = .19$, $p = .05$).

Child SFS palate is significantly predicted by child brand knowledge ($\beta = .65$, $p < .001$). Child SFS palate is not directly predicted by child fast-food consumption ($\beta = .05$, *ns*), nor by parent SFS palate ($\beta = .03$, *ns*). These findings are intriguing, given that there is a basic correlation between frequency of child fast-food consumption and child SFS palate ($r = .28$, $p < .01$), and also between parent and child SFS palate scores ($r = .20$, $p < .05$). Hence, checks for mediation were considered. First we examined whether the relationship between child fast-food consumption and SFS palate is mediated by brand knowledge. We then also assessed whether the relationship of parent SFS palate to child SFS palate is mediated by frequency of child fast-food consumption. Bootstrapping was used to test the indirect relationships. The first test revealed a significant indirect effect of fast-food consumption on child SFS palate, with child brand knowledge as the mediator (standardized estimate = .178, $p = .001$, C.I.: .009 to .275). The relationship between parent SFS palate and child SFS palate was found to be significantly mediated by child fast-food consumption (standardized estimate = .058, $p < .05$, C.I.: .009 to .138).

Finally, brand knowledge is a significant predictor of SFS palate ($\beta = .65$, $p < .001$) and SFS palate is a significant predictor of a child's choice of foods that provide "flavor-hits" ($\beta = .30$, $p < .01$).

Study 2 Discussion

In the structural equation model, brand knowledge predicts palate development. The basic correlation between these variables is interesting in and of itself since it suggests that fast-food and soda brand knowledge is linked to the development of a preference for sugar, fat and salt in food. We believe the posited directionality of relationships can be explained in terms of children with greater brand knowledge experiencing positive associations between emotional experiences and food brands and that these associations facilitate the development of pervasive taste preferences. We contend that brand knowledge is antecedent to development of taste preferences. Alternative arguments would be that taste preferences lead to greater attention to advertising for preferred foods or that high television viewing might result in eating more foods high in sugar, salt, and fat. Given the tendency of children to choose that which is familiar, it is hard to imagine a child of this age choosing which brands of food to consume on the basis of preexisting taste preferences. First, they would need to be aware of the tastes they enjoy, and then decision-making would require the child to judge the availability of branded offerings that satisfy the desired tastes. Preschoolers are unlikely to engage in such sophisticated thinking, therefore, we believe that experience with brands predicts palate. This argument is also in keeping with literature that shows advertising as having the ability to frame food experience (Moore & Lutz, 2000).

Interestingly, fast-food consumption experience is not a direct predictor of SFS palate. The results indicate that fast-food consumption is only predictive of SFS palate when children have processed and stored information about the fast-food and soda brands. This is a new insight into the individual differences present in children's experiences and outcomes. Also interesting but somewhat more readily understood from past research is the fact that parent palate does not directly influence child palate but rather influences it via child fast-food consumption occasions.

SFS palate was found to predict flavor-hit behaviors. Children whose palate favors foods high in sugar, fat, and salt seek "flavor-hits," add flavor to their foods, and complain when flavor is not added. This finding is general in the sense that it applies to branded and unbranded foods. It indicates that once a SFS palate has formed, a child's consumption behavior is affected to an extent where less flavorful foods are no longer acceptable to the child. Arguably, active attempts to seek flavor, add flavor, and reject less flavored foods may direct children along a path to obesity since many flavor adding condiments are high in sugar, fat, and salt. Further research is needed to confirm this proposition (e.g., to determine whether flavor-hit behavior is predictive of unhealthy BMI scores), however, there is no question that in the modern marketplace foods which satisfy a flavor-hit rarely represent healthy choices.

The current research considered children who were primarily Caucasian. Given past findings of high levels of fast-food promotion to Hispanics and African Americans as well as more convenient location of fast-food restaurants to them (Grier et al., 2007) it is likely that these findings would be amplified if replicated with a more diverse sample. Further research is needed to explore whether taste preference are developed by exposure to other flavor-hit foods, for example, salty snack chips or sugar-sweetened cereals that may be consumed at home where children are served foods from packaging but in the absence of commercial environment cues such as a fast-food restaurant, vending machine, or soda fountain. Exploring links with ethnicity and age may also provide a more informed explanation for the link from VMA to SFS palate.

Also left unexplored is any possible habituation or addiction to sugar, fat, and salt. We prefer the term habituation. Children in this study were shown to seek out additional flavoring (perhaps suggesting an increasing tolerance), with much of this flavor coming via additional sugar, fat, and salt. Recent research on adult populations argues that addiction to refined foods could be considered a classic substance use disorder (Ifland et al., 2009). One of the dependence criteria important to classification as "addictive" is that there is progressive use over time including an increased amount of a substance to achieve a desired effect and diminished effect with continued use of the same amount of the substance. Addiction is also marked by other criteria such as withdrawal and recovery from use (Ifland et al., 2009), therefore, the behaviors examined in the current research cannot be seen as addictive behaviors.

General Discussion

The obesity challenge is a multifaceted problem of immeasurable importance. It will take a multifaceted and immeasurably large effort from all parties to enact the level and extent of change needed to put world health on a better trajectory. This research on child palate contributes to the potential for change by firstly identifying that early food-related behaviors are important to the discussion and by offering a new focus for food manufacturers, policy, and future research.

As an example of the need for manufacturers and policy makers to work together, consider the challenge for families of consuming adequate servings of fruit and vegetables per day. Advocating the importance of five servings of fruit and two vegetable servings each day is good policy but the price index of fresh fruits and vegetables has risen at a rate double that of the consumer price index overall in the past 30 years (Brownell & Frieden, 2009) making fresh foods expensive. Even simply processed fruits and vegetables often have added sugar or salt. In fact, the per capita consumption of high fructose corn syrup (an ingredient in many refined foods) rose 1240 percent from 1970 to 1997 (Ifland et al., 2009). What is a family to do? Availability of affordable nutrient rich foods not high in sugar, salt, and fat needs to be a priority for families, manufacturers, communities, and policy makers.

As food and drink manufacturers and restaurants face increasing public pressure for reform, it seems voluntary reformulation of products in advance of policy mandates may be best. Product reformulations are expensive, as is any potential loss of market share. This research suggests that manufacturers may want to prioritize product modification starting with product lines targeted to children. While the results here are preliminary, it seems that marketers are already cognizant of the need for change. An available example comes from the Campbell Soup Company's Kids offerings that have lower salt and fat and no MSG or artificial flavoring (Drug Week, 2009).

Food and drink manufacturers and restaurants should also critically examine their role in creating brand associations to food experiences. Associative conditioning is a well-established process in the development of food preferences. Although limited to only two brands of fast-food and two soda brands, this research offers confirmation of the findings of McAliser and Cornwell (2010) in showing that preschoolers exhibit extensive brand knowledge regarding fast-food and soda brands. This research goes further in terms of identifying some of the likely antecedents of these brand associations as TV viewing and consumption experiences. As noted by an anonymous reviewer, the main argument by the food industry to justify marketing to children is that companies only influence brand preferences, not preferences for categories of foods. Findings from the present research show that food marketing may not just influence category consumption but also fundamentally change children's taste palates to increase their liking of highly processed and less nutritious foods (i.e., those most commonly advertised).

Next Steps for Research

The SFS scale is a particular methodological contribution that may be useful in research further examining the nomological net of child palate development. While the data utilized here are cross-sectional and we are yet to fully establish the psychometric properties of the new SFS scale, in future it may be useful in marketing and public policy research and also to work in preventative health, sociology of food consumption and nutrition. More generally, the findings here open a new set of research questions at the intersection of marketing, policy, psychology, and human ecology.

There is more work to be done in terms of examining the pervasiveness of taste preferences. This research is a starting point in showing that parent and caregiver assessments of a child's general SFS preferences are related to the child's food preferences. These general tendencies are in turn related to the desire to add flavor to food. Admittedly, our findings only suggest the potential explanatory role that might be played by pervasive palate preferences. Our argument that a pervasive palate preference is malleable and is modified by experience is in keeping with literature in child development (Myers &

Sclafani, 2006). The ideas that we hope future research can further explore are the various influences on this development and the extent to which this preference influences food choice without explicit consideration.

Focus on addressing development of a SFS palate by children and their families has several communication advantages in terms of changing dietary behavior. First, focus on palate development addresses both the reduced consumption of low-nutrient "junk" foods as well as possible increased consumption of healthy foods. Second, as a communication strategy, it moves away from issues of weight and weight loss diets. Clearly, if additional future research confirms the current findings that palate plays an important early role in the development of detrimental patterns of food choice; then policy and programs have a different lever. The focus on diet and weight control is not working or is not working fast enough. Discussion of palate presents new options for communication and intervention.

Future research could investigate, perhaps through choice modeling, the specific components responsible for positive associations. Is it the McDonald's or Burger King logo that "tells" a child the food will taste good or is it simply bright colors, bright lighting, and the presence of a playground and drive-thru? With soda brands, is it the excitement of seeing the soda delivered via a soda fountain that makes the drink "taste better"? If a soda fountain is what makes the drink taste better, could plain milk be delivered in this manner at restaurants to instill in children the positive emotional association needed to develop a taste palate favoring milk? Indeed, this is what Robinson and colleagues' (2007) results would suggest: their sample of three- to five-year-olds preferred the taste of carrots and milk that were presented as branded.

While these findings are not conclusive, it is still reasonable to urge parents of young children to consider their own palate preferences, as well as those of their child, and how these preferences develop. Some adjustments to reduce a strong sugar, fat, and salt preference may be easier to make than reduced calorie diets. For example, a simple and relatively effortless first step might be to keep saltshakers in the pantry, and condiments out of sight. An eating environment that does not feature reminders of flavor enhancement may reduce children's likelihood of requesting such additions to their food. While guarding against obesity, a diet low in sugar, fat, and salt may also be higher in nutrients. Parents need to also be cognizant of their role in exposure opportunities for children's consumption as well as brand association building via advertising. As one parent explained, "my child doesn't really watch much TV, it's just on in the background." There may be previously unidentified ways to limit brand association development.

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Table 1

Study 1 Exploratory Factor Analysis (with Oblique Rotation) of Sugar, Fat, Salt, and Flavor Survey Items, Following Removal of Item 14

Items	Factors 1	Factors 2	Factors 3
5: Child requests that sugar be added to breakfast cereals.	**.94**	.04	-.23
6: Child likes salty foods.	**.92**	.01	-.18
2: Child likes sugary dessert foods.	**.90**	-.09	-.10
17: Child's preferred meals are typically high in salt.	**.84**	-.09	.18
*16: Child requests that sweet drinks be diluted.	**.79**	.09	.34
3: Child likes deep fried foods such as fries or hash browns.	**.78**	-.05	-.19
12: Child requests that salt be added to home-cooked meals.	**.75**	.21	.12
*19: Child sometimes complains that food is too sweet.	**.67**	.03	.48
20: Child prefers vegetables to be fried rather than steamed or boiled.	**.62**	-.05	.09
*18: Child shows awareness and concern regarding fatty foods.	**.54**	.08	.14
10: Child's favorite foods are typically high in fat.	**.51**	.19	-.29
7: Child eats intensely flavored foods like Cheetos and Doritos.	.02	**.92**	.07
4: Child adds extra flavor to food s/he is served (e.g., ketchup, gravy, spices).	.06	**.92**	-.06
21: Child complains that food tastes plain if it does not have flavor added (e.g., wants butter on popcorn or toppings on ice cream).	.02	**.81**	-.05
*11: Child avoids foods that have a big "flavor-hit" (e.g., sour worms).	-.10	**.79**	.04
Variance explained	49.33%	19.27%	6.70%

Note. * Denotes reverse-scored item.

Table 2

Taste Ratings of Stimulus Foods Included in the "Food Choice Task" Completed by Children (1 – 5 Scale)

Natural Foods	*N*	*M*	*SD*	Flavor-Added Foods	*N*	*M*	*SD*
Corn	34	3.79	1.01	Corn chips	62	4.26	1.09
Cheese	66	3.77	1.20	Cheese puffs	65	4.14	1.47
Strawberries	67	4.10	1.10	Strawberry ice-cream	67	4.81	.56
Watermelon	67	4.15	1.10	Watermelon hard candy	47	4.17	1.45
Apples	66	3.67	1.22	Apple suckers	49	4.33	1.16
Bananas	66	3.42	1.44	Banana candies	56	3.88	1.35
Tomatoes	63	2.97	1.48	Ketchup	67	4.58	.70
Water	67	3.09	1.29	Cola	62	4.18	1.29
Milk	67	3.13	1.58	Chocolate milk	67	4.18	1.22
Fruit salad	61	3.51	1.36	Fruit flavored cereal	67	4.37	.97
Green beans	51	2.20	1.17	Jellybeans	67	4.76	.43

Note. The number of participants varies across foods because some children reported having never before tasted some of the foods and so did not qualify to rate the taste of those foods.

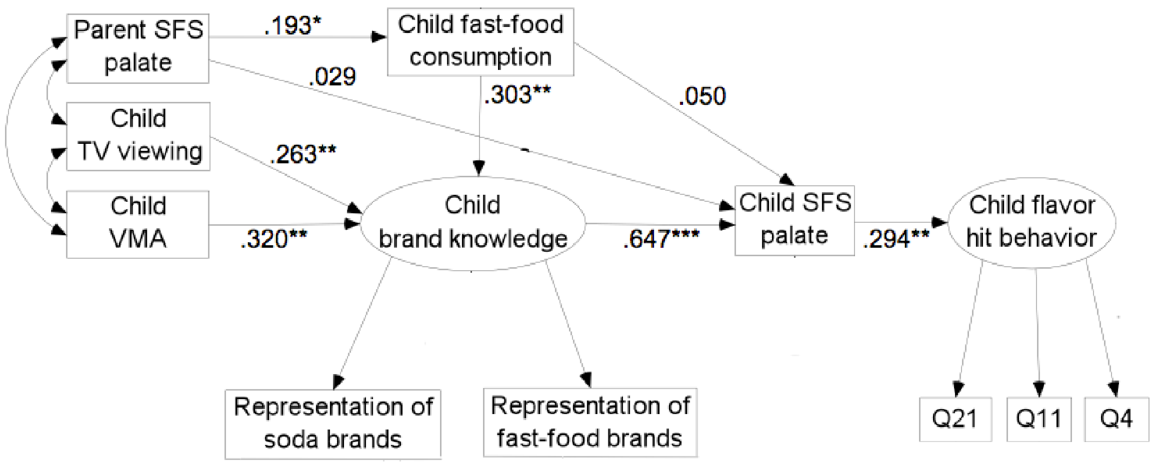

Figure 1. Structural equation modeling results showing beta weights on paths. Predicting child SFS palate from child brand knowledge, while assessing TV viewing hours, verbal mental age, and frequency of fast-food consumption as predictors of brand knowledge. Parent SFS is included as a predictor of a child's frequency of fast-food consumption.

Note. * $p = .05$, ** $p < .01$, *** $p < .001$.