Research report

Perceived recollection of frequent exposure to foods in childhood is associated with adulthood liking

Devina Wadhera *, Elizabeth D. Capaldi Phillips, Lynn M. Wilkie, May M. Boggess

Department of Psychology, Arizona State University, 950 S. McAllister Ave., Tempe, AZ 85287-1104

A R T I C L E   I N F O

Article history:
Received 7 March 2014
Received in revised form 13 January 2015
Accepted 15 January 2015
Available online 20 January 2015

Keywords:
Food preferences
Childhood recall
Childhood food exposure
Parenting style

A B S T R A C T

Food preferences and habits learned at a young age can influence adulthood dietary patterns and weight, but the mechanism remains to be elucidated. We investigated the effect of perceived recollections of early food experiences on current liking for those foods by 670 college students. We showed that the perceived recollection of frequent consumption of foods in childhood was significantly related to current liking for the vast majority of the foods, including nutritious foods such as vegetables. Similarly, parental encouragement and modeling was positively related with current liking, even for foods that were disliked in childhood. Additionally, perceived recollections of parental restriction or forced consumption were significantly negatively related with current liking. Lastly, we demonstrated that perceived recollections by college students of childhood eating practices were in moderate agreement with those of their parents, lending credibility to the retrospective survey methodology in determining long-term effects of exposure on current food habits. These findings show that the perceived recalled frequency of consumption of foods is one determinant of the food preferences of adults, demonstrating a long-term effect of frequency of exposure, a finding consistent with experimentally controlled short-term studies. Frequent exposure to foods in childhood could be a simple and effective way for parents and caregivers to instill healthy eating habits in children.

© 2015 Elsevier Ltd. All rights reserved.

Introduction

Childhood eating practices can contribute to the development of adult food preferences and dietary habits. College students who recalled being rewarded with food, given desserts, and allowed to stop eating when satiated were more likely to report these eating habits in adulthood (Branen & Fletcher, 1999). Some eating patterns developed in childhood can lead to problematic eating behaviors and weight concerns later. For example, subjects who were forced to clean their plates or when rewarded or punished with food were more likely to be overweight and display binge-eating behaviors (Branen & Fletcher, 1999; Brunstrom, Mitchell, & Baguley, 2005; Galloway, Farrow, & Martz, 2010; Puhl & Schwartz, 2003). Similarly, when forced to consume a food in childhood, a majority of subjects reported a current disliking for the food and were unwilling to eat it (Batsell, Brown, Ansfield, & Paschall, 2002; Branen & Fletcher, 1999).

Just as aversive childhood experiences can lead to unhealthy eating patterns and food aversions, favorable food experiences may lead to healthy eating patterns since learning plays an important role in establishing eating habits. One influence known to increase food preferences in children in the short-term is repeated exposure. Children show a preference for a novel food when exposed to that food eight to ten times (Bertino, Beuchamp, & Engelman, 1986; Birch & Marlin, 1982; Lakkakula, Geaghan, Zanovec, Pierce, & Tuuri, 2010; Mattes, 1994). However, studies on the long-term effects of childhood exposure to foods on adult food preferences are limited.

Here, we examined the long-term effects of childhood exposure to foods on current liking by college students using retrospective reporting (Branen & Fletcher, 1999). Although determination of exact experiences cannot be determined with retrospective reporting, what an adult remembers as occurring in childhood will be influenced by salience (Sheingold & Tenney, 1979) and repetition. We use the vocabulary perceived recollections to account for the fact that our subjects’ answers are influenced both by their subjective perspectives and by the passage of time since childhood. Due to the extensive utilization of retrospective reporting in other studies (Batsell et al., 2002; Branen & Fletcher, 1999; Brunstrom et al., 2005; Chavarro et al., 2009; Galloway et al., 2010; Marutí et al., 2005; Puhl & Schwartz, 2003), and the validity and reliability of this method (Chavarro et al., 2009; Marutí et al., 2005), we believe that retrospective reporting can be used to accurately determine the long-term effects of exposure to foods in childhood on adulthood food preferences.

With the exception of a few studies (Puhl & Schwartz, 2003), retrospective reporting of childhood food experiences have been limited
to aversive experiences and situations associated with those events (Logue, Ophir, & Strauss, 1981). Few studies have considered using retrospective reporting to examine the effects of normative childhood eating experiences and their influence on current food preferences. If recalled aversive eating episodes can determine current dislikes for those foods, we hypothesized here that perceived recalled positive eating experiences in childhood may influence current liking for those foods.

Here, we measured the effects of perceived recollections of exposure to foods in childhood by asking college students (subjects) and their parents to retrospectively report subjects' perceived frequency of consumption of foods in childhood. As mentioned previously, previously reported exposure involves presenting a novel food several times (Birch & Marlin, 1982). The term "exposure" therefore, simply refers to repeated consumption. In the laboratory, repeated consumption leads to greater current liking than infrequent consumption or no exposure (Bertino et al., 1986; Birch & Marlin, 1982; Lakkakula et al., 2010; Mattes, 1994). We assumed these laboratory findings would translate to actual experience so that foods consumed more frequently in childhood would be liked more than those eaten less frequently. To investigate this notion, we determined the effects of perceived recalled frequency of consumption of foods in childhood on current food preferences, by asking subjects to indicate their current liking for the same foods. Assuming liking is either long lasting, and/or leads to continued consumption or no exposure (Bertino et al., 1986; Birch & Marlin, 1982; Lakkakula et al., 2010; Mattes, 1994). We assumed these laboratory findings would translate to actual experience so that foods consumed more frequently in childhood would be liked more than those eaten less frequently. To investigate this notion, we determined the effects of perceived recalled frequency of consumption of foods in childhood on current food preferences, by asking subjects to indicate their current liking for the same foods. Assuming liking is either long lasting, and/or leads to continued greater consumption we expected that a subjects' salient memory of frequently consuming a food in childhood would be associated with a current liking for the food and that rarely consuming the food in childhood would be associated with a decreased liking for it.

Parents also play an important role in exposure and availability of foods at home (Baranowski et al., 1993; Gibson, Wardle, & Watts, 1998) and in the development of children's eating habits. Since parental restriction of foods can negatively impact liking for those foods in childhood, we hypothesized that college students will currently dislike foods that they recall as not being allowed or restricted to eat in childhood. In addition, since parental encouragement and modeling has been positively related to children and adolescents' food intake (Pearson, Biddle, & Gorely, 2009), we hypothesized that encouragement and modeling will be positively related to current liking.

Method

Subjects

Subjects were recruited from an introductory psychology pool at Arizona State University in three waves from 2009 to 2011, administered four months apart. All subjects were given course credit for their participation. Only those who primarily spoke English and were at least 18 years of age were included in the analysis. Wave 2 included a greater variety of questions regarding parental behaviors with respect to food, as did wave 3. There were two additional goals of wave 3: one was to assess repeatability, so some foods were asked twice, and the second was to assess subjects' concurrence with parental recollection. To this end, subjects in wave 3 provided their own name and the name and email address of their primary caregiver who was subsequently emailed a link to a web-based survey. This allowed us to match parents' survey responses with their children’s. Waves 1 and 3 were administered online and wave 2 was given on paper in a laboratory setting. Subjects in all waves were given one opportunity to complete the survey and no reminders were given. Gender, age, height, and weight were collected from all subjects, from which body mass index (BMI) was calculated.

The Arizona State University Human Subjects IRB approved all studies, and experimental procedures were performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

Selection of foods

Foods utilized in the present study were intended to be commonly preferred or rejected by children. Foods high in added fats and sugars were included because some parents restrict their children’s consumption of these foods or use them as reward or punishment for their children's behavior (Birch & Fisher, 1998). Restricting access or punishing and rewarding children with foods has been shown to result in a greater preference for and overconsumption of these foods by children and this may result in long-lasting effects on later food preferences.

Likewise, vegetables were included because children are often forced to consume these foods in childhood and consequently, dislike them because of the negative experiences associated with the forced consumption episodes (Batsell et al., 2002; Brennan & Fletcher, 1999).

Meats were also included because younger children often display neophobic behaviors that limit their dietary repertoire, particularly the consumption of meats and vegetables (Cooke, Carnell, & Wardle, 2006; Falciglia, Couch, Gribble, Pabst, & Frank, 2000) and the perceived recollection of attitudes toward these foods may determine their current liking for these foods.

Categorization of foods

The foods were grouped in a manner consistent with the grouping system of the US Department of Agriculture Dietary Guidelines: vegetables, fruits, and dairy (US Department of Health & Human Services, 2010). Four additional groups were created for foods containing multiple ingredients. These foods were categorized based on their proportional macronutrients. Foods with >50% carbohydrate, fat, or protein were placed in high-carbohydrate, high-fat, and protein categories respectively, whereas foods with >40% of both carbohydrates and fats were placed in the high fat/high carbohydrate group. There were 15 dairy, 23 fruits, 22 vegetables, 15 protein, 16 high carbohydrate, 14 high fat, and 27 high fat/high carbohydrate foods that were used in this study. The order of the 122 foods in the survey instruments was random.

Perceived recollections

Subjects were asked their perceived recollections of how frequently they consumed a food (frequency of consumption) and their parents' attitudes and practices toward that food during their childhood. Subjects were instructed to think back to when they were in elementary school (up to the age of 10 years) and mark how frequently they ate the food and how the food was treated in their household by their parents. This age range has been used regularly in other retrospective reporting studies since it is believed family food rules are clearly enforced by age 10 (Batsell et al., 2002; Brunstrom et al., 2005; De Bourdeaudhuij, 1997; Galloway et al., 2010).

For each food, subjects selected one from three options concerning frequency of consumption: “I ate this frequently” (frequently eaten), “I ate this rarely” (rarely eaten), or “I never tried this” (never). In wave 1, they selected one from three options concerning their parents’ attitudes and practices: “parents made me eat” (forced), “parents did not let me eat” (not allowed) or “parents didn’t care if I ate” (indifferent). Wave 2 included two additional options of “parents allowed me to eat in moderation” (moderation) and “parents did not make this available to me” (unavailable) to capture other aspects of a subject’s childhood food experiences. In wave 3, “unavailable” and “indifferent” were not asked but one more option was added.
included: “I was encouraged to eat this” (encouraged). Additionally, "I saw my parents eating this frequently" (saw) and "I liked eating this food" (liked) were asked in wave 3. For the survey given to parents in wave 3, the vocabulary was modified such that the statements read, for example, "my child ate this food".

Current food liking

Subjects indicated their current liking for foods on a Generalized Labeled Magnitude Scale (gLMS) that ranged from −100 (strongest imaginable liking of any kind) to −100 (strongest imaginable disliking of any kind). The gLMS has been used reliably in other studies to measure liking for foods and beverages (Duffy, Hayes, Sullivan, & Faghri, 2009; Duffy et al., 2007) because it allows for accurate within-group comparisons both by extending the scale to a maximum (Bartoshuk et al., 2004) and by asking subjects to compare the intensity of liking with endpoints not related to food (Bartoshuk, 2000).

Accuracy of responses

Children gradually develop autobiographical memory (Nelson & Fivush, 2004) and make more memory errors than do adults (Johnson & Foley, 1984), thus a valid methodological concern is the accuracy of college-aged adults' memories of childhood experiences. To assess internal consistency of responses, current liking was asked twice for eight foods and recall questions were asked twice for nine foods, to allow for comparison of the two responses.

Parents may have a more accurate memory of the food habits and practices in their family, thus in wave 3 we asked a parent the same recall questions as the subject. We used the level of agreement between parent and child to assess the accuracy of the fully-grown child's recollections.

Statistical analysis

Cronbach’s alpha and correlation between current liking responses for the foods that were asked twice was used to estimate the strength of agreement between the two responses. Cohen’s kappa and percentage agreement between recall questions for the foods that were asked more than once were used to estimate the strength of agreement between the responses. These measures were also used to estimate the strength of agreement between subject and parent responses to recall questions. Separate linear regressions (by food group) were run, with parental practices and frequency of consumption variables as independent variables and average liking as the dependent variable. Subjects were added as a random effect (Laird & Ware, 1982) to the model to account for lack of independence between responses from the same subject. Significance was determined at the 5% level. All data manipulations and statistical analyses were performed using Stata MP version 13 (StataCorp LP, 2013).

Results

A total of 306 subjects participated in wave 1, 184 in wave 2, and 180 in wave 3. All subjects were aged 18 or older and primarily spoke English. This resulted in a total of 670 subjects. Of the 180 subjects in wave 3, 128 parents responded to the parent survey. Body Mass Index (BMI) was calculated from each subject’s self-reported height and weight. Female subjects (n = 369) were, on average, 18.6 years of age with BMI of 22.5. Male subjects (n = 301) were, on average, 19.3 years of age with BMI of 23.9. Female parents (n = 104) were, on average, 48.3 years of age with BMI of 25.3. Male parents (n = 24) were, on average, 51.0 years of age with BMI of 27.9. Percentages of responses for each frequency of consumption and parental practice question are listed in Table S1 by food. Note that for the vast majority of foods, the most popular response was parents were indifferent, even for energy-dense foods such as soda, French fries, and brownies. There was a shift to increased forcing for fruit and vegetables, but indifferent was still the most popular response. Green beans and broccoli were the only foods for which the percentage of parents forcing their children to consume these foods was higher than the percentage indifferent to these foods.

Internal consistency

For eight foods, 177 subjects responded twice with their current liking of that food. For seven foods, Cronbach’s alpha was greater than or equal to 0.90 and had a correlation greater than 80%, which indicated excellent agreement. For collard greens, agreement was good (alpha 0.85, correlation 75%). For all foods combined, Cronbach’s alpha was 0.94 and the correlation was 89% (95% confidence interval (CI) 87–91%, N = 1416).

For 10 foods, 180 subjects responded twice about the recollection of their frequency of consumption and parental practices concerning that food. For “frequently eaten”, “never” and “rarely eaten” Cohen’s kappas were 0.92, 0.89 and 0.83 (96%, 96% and 92% agreement), which indicated almost perfect agreement. Kappas for recollections of liked and parental practices were not as high, but still indicated substantial agreement: “liked”, “forced”, “encouraged”, “not allowed” and “saw” had kappas 0.79, 0.77, 0.72, 0.69 and 0.67 (89%, 99%, 92%, 99% and 90% agreement), respectively. The lowest percentage agreement for individual foods was 81% (kappa 0.61) for “parents encouraged me to eat apples”.

Subject-to-parent agreement

Cohen’s kappa and percentage agreements were used to judge the strength of agreement between parent and subject on frequency of consumption and parental variables. One hundred and twenty eight parents responded about their child’s eating of 96 foods. The subject-to-parent agreement was higher for the frequency of consumption than parental variables. Kappas for “frequently eaten” and “never” were moderate (0.56, 0.50 and 80%, 80% agreement, respectively) and for “liked” and “rarely eaten” were fair (0.39, 0.29 and 70%, 67% agreement respectively) for all foods. For parental variables, the subject-to-parent agreement ranged from fair to slight. Kappa for “encouraged” was fair (0.26 and 78% agreement) and for “forced”, “saw” and “not allowed” was only slight (0.18, 0.15, 0.10, respectively, 98%, 68%, 99% agreement, respectively). These agreement levels did not vary between food groups. The only exception was “encouragement” where there was somewhat higher agreement that children were not encouraged to eat high fat/high carbohydrate and high fat foods (91% and 86% agreement), compared to fruit and vegetables (67% and 69% agreement), although all food group kappas were between 0.16 and 0.26.

Effect of recalled childhood liking, frequency of consumption, and parental practices on adulthood liking by food group

Figure 1 displays the average current liking of foods by childhood frequency of consumption and parental practice. Average current liking was calculated from responses for 122 foods by 665 subjects. As evidenced by the large, significant differences in current liking, frequency of consumption of food had a much greater impact on current liking than parental practices, and there was good agreement between parents and subjects on frequency of consumption than parental variables. Foods that were frequently eaten in childhood were liked the most, followed by rarely, and never eaten. The most positive parental practice on current liking was encouragement.
Effect of perceived recalled childhood liking, frequency of consumption, and parental practices on current liking by food group

Figure 2A and B compares the average current liking for foods that were liked to those that were recalled as being disliked in childhood by recalled childhood frequency of consumption and parental practice variables, broken out by food group. Average current liking was calculated from responses to 96 foods combined for 177 subjects. Importantly, foods that were disliked and recalled as never eaten in childhood were currently disliked (average current liking was significantly less than zero). Interestingly, food groups that were disliked and recalled as eaten only rarely in childhood were more currently liked than those that were disliked and recalled as never eaten. Foods that were disliked in childhood but eaten frequently were currently liked just as much as foods that subjects liked in childhood but ate rarely. This was true for all food groups except vegetables and proteins.

Some parental practices had a positive impact on current liking, particularly for foods that were disliked in childhood. Parental modeling and encouragement were associated with current liking, even for foods that were disliked in childhood. Parental forcing of disliked foods in childhood was associated with current liking for high-fat/high-carbohydrate, high carbohydrate, dairy, and fruits, but not for proteins, vegetables, and high-fat foods. On the other hand, parental practices had no effect on current liking for foods that were already liked in childhood.

**Fig. 1.** Average current liking for recalled childhood liking, frequency of consumption, and parental practice, with 95% confidence intervals (122 foods, n = 665 subjects). Note. In the figure, “Recalled liking” referred to “I liked eating this food”; “Ate frequently” was “I ate this frequently”; “Ate rarely” was “I ate this rarely”; “Never ate” was “I never tried this”; “Encouraged” was “I was encouraged to eat this”; “Saw parents eat” was “I saw my parents eat this frequently”; “Allowed in moderation” was “parents allowed me to eat in moderation”; “Parents indifferent” was “parents didn’t care if I ate”; “Parents forced” was “parents made me eat”; and “Not available” was “parents did not make this available to me” in the surveys.

**Fig. 2.** A and B. Average current liking of 96 foods combined for 177 subjects by childhood frequency of consumption and parental practice variables, broken out by childhood liking and food group. Note. In the figures above, “Recalled liking” referred to “I liked eating this food”; “Frequently” was “I ate this frequently”; “Rarely” was “I ate this rarely”; “Never” was “I never tried this”; “Encouraged” was “I was encouraged to eat this”; “Saw parents” was “I saw my parents eat this frequently”; “Allowed in moderation” was “parents allowed me to eat in moderation”; “Parents indifferent” was “parents didn’t care if I ate”; “Parents forced” was “parents made me eat”; and “Not available” was “parents did not make this available to me” in the surveys.
Effect of perceived recalled childhood liking and frequency of consumption on current liking by food

Figure 3A–E shows the average current liking for each food by childhood frequency of consumption and liking. All foods that were eaten frequently or liked in childhood were currently liked (average current liking significantly greater than zero). For the majority of foods, current liking for foods was similar for those that subjects recalled as already liking in childhood and those that they consumed frequently, showing that frequent exposure to foods in childhood led to current liking to the same degree as having a pre-existing liking for that food. Liking a food in childhood had a stronger impact on current liking than frequent consumption for many fruits and vegetables, but not for other foods.

The information displayed in Fig. 3A–E is summarized in Table 1. Frequent consumption of foods in childhood led to greater current liking for majority of foods in all food groups.

Lack of consumption of foods in childhood led to current disliking as shown in Fig. 3A–E. This was beneficial for a variety of unhealthy foods, such as Twinkies, cream-filled doughnuts, fast food burgers, onion rings, and bacon, in that these foods were never eaten in childhood and were, on average, currently disliked. However, the same effect was seen with meats, fruits, and vegetables. All vegetables (except for broccoli and roast potato), were currently disliked if never eaten in childhood. Similarly, fruits such as cantaloupe, watermelon, apricots, grapefruit, prunes, honeydew melon, plums and tomatoes, and meats such as sausage, roasted chicken, and turkey were currently disliked if never eaten.

Some foods were currently liked even though they were never consumed in childhood. Many sweet foods such as M&Ms, brownies, cinnamon rolls, cheesecake, frozen yogurt, and smoothies were currently liked even though subjects recalled never eating them in childhood. Mango and strawberries were the only fruits never eaten in childhood that were currently liked. There were no vegetables in this category.

There were some foods for which there were no differences in current liking based on childhood frequency of consumption. These tended to be sweet foods, such as ice cream, frozen yogurt, milkshake, M&Ms, and desserts, such as mousse, pudding, and fruit tart.

The only fruits in this category were apples, strawberries, and grapes. Current liking for snack foods such as French fries, chocolate chip cookies, almonds, brownies, Popsicles, pop tarts, popcorn, and potato chips was not significantly different if rarely or never eaten. In the same category but at the other end of the spectrum were strongly-flavored vegetables for which occasional consumption had no impact on liking in adulthood, such as Swiss chard, collard greens, zucchini, and lima beans.

Effect of perceived recalled parental practices on current liking

Figure 4A–E shows the average current liking by parental practices for each food. A visual comparison of these figures to Fig. 3A–E revealed much wider confidence intervals and therefore most intervals were overlapping, indicating that parental practice was much less impactful on current liking than frequency of consumption.

Overall, the effects of parental practices on current liking were small and were dependent on the type of food. Table 2 summarizes few foods for which current liking was affected by parental practice.

Parental encouragement led to greater current liking for foods than either parental indifference or parental force. This was particularly true for milk (whole, 1%, 2%, and fat-free), fruits (e.g. cantaloupe, cherries, honeydew melon, raspberries, strawberries), and vegetables (broccoli, cauliflower, and spinach).

Current liking for all foods did not differ significantly based on when subjects recalled watching parents eat versus being encouraged by parents to eat, so responses to these variables were combined (saw/encouraged). For all foods, foods were currently liked either more or the same amount when subjects saw parents eat or were encouraged to eat those foods as compared to parents forcing or being indifferent to the consumption of those foods.

Only fat-free milk was liked more currently when parents forced subjects to consume that food in childhood than when parents were indifferent. On the other hand, current liking was lower for beef, shrimp, roasted chicken, and plums when subjects recalled being forced to consume these foods in childhood. Parental restriction led

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Foods for which current liking was unaffected or affected by childhood frequency of consumption.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High fat/high carbohydrate</strong></td>
<td><strong>High fat/high carbohydrate</strong></td>
</tr>
<tr>
<td>Twinkies, cream-filled doughnuts, mac and cheese, beef burger, crackers and cheese, chicken burger, onion rings</td>
<td>Cinnamon rolls, Hash browns, M&amp;Ms</td>
</tr>
<tr>
<td>High carbohydrate</td>
<td>M&amp;Ms, ice cream</td>
</tr>
<tr>
<td>Tuna sandwich, Jell-O, oatmeal</td>
<td>Brownies, smoothie, breadsticks</td>
</tr>
<tr>
<td>High fat</td>
<td>Cheese quesadilla, cheesecake</td>
</tr>
<tr>
<td>Bacon, sausage, potato salad</td>
<td>Mousse</td>
</tr>
<tr>
<td>Dairy</td>
<td>Almonds, popcorn, potato chips</td>
</tr>
<tr>
<td>Cottage cheese, whole milk</td>
<td>Frozen yogurt</td>
</tr>
<tr>
<td>Protein</td>
<td>Frozen yogurt</td>
</tr>
<tr>
<td>Roasted chicken, lobster, turkey</td>
<td>Frozen yogurt, pudding</td>
</tr>
<tr>
<td>Fruit</td>
<td>Steak</td>
</tr>
<tr>
<td>Prunes, plums, watermelon, honeydew melon, cantaloupe, apricots, grapefruit, tomatoes</td>
<td>Mango, strawberries</td>
</tr>
<tr>
<td>Vegetables</td>
<td>Apples</td>
</tr>
<tr>
<td>All, other than broccoli and roast potato</td>
<td>Swiss chard</td>
</tr>
</tbody>
</table>

Note: a Foods that were never eaten in childhood and currently disliked.

b Foods that were never eaten in childhood but currently liked.
c Foods for which current liking was the same if eaten frequently as when never eaten in childhood.
d Foods for which current liking was the same if eaten frequently as when eaten rarely.
e Foods for which current liking was the same if eaten rarely as when never eaten in childhood.
Fig. 3. A–E. These figures show the average current liking for each food, by childhood frequency of consumption (never, rarely, and frequently) and childhood liking (like) by food group.

Note. In the figures above, “Never” was “I never tried this”; “Rarely” was “I ate this rarely”; “Frequently” was “I ate this frequently”; and “Liked” was “I liked eating this” in the surveys. (A) Displays the high fat/high carbohydrate group, (B) the high carbohydrate group (top) and high fat group (bottom) combined into one figure, (C) the dairy and protein groups combined into one figure, (D) fruits, and (E) vegetables.
to lower current liking for foods than parental indifference. This was particularly true for foods high in carbohydrate and fat content such as Twinkies, PBJ, chicken burger, crème-filled doughnuts, bacon, hot dog, chicken nuggets, and milkshake.

Discussion

We found that current liking for foods was affected by frequency of consumption of those foods in childhood, and the effect of recalled frequency of consumption was greater than the effect of recalled parental practices. The most effective parental technique that improved current liking was parental encouragement, and this combined with frequent consumption was the most effective way to promote liking for foods in adulthood. These results are consistent with the theory that frequent exposure to foods facilitates preference, as opposed to children frequently consuming foods they already liked, because exposure effects were found even for foods that subjects reported as disliking and that are typically disliked in childhood, such as vegetables, fruits, and meats (Cooke et al., 2006; Cooke, Wardle, & Gibson, 2003; Pliner, 1994).

Effects of childhood frequency of food consumption

Previous literature supports the conclusion that repeated exposure facilitates short-term liking for foods in both children and adults (Birch & Marlin, 1982; Lakkakula et al., 2010; Pliner, 1982; Sullivan & Birch, 1990; Wardle, Herrera, Cooke, & Gibson, 2003). These studies were experimentally controlled and measured the change in preference over a few months at most. Our results extend these findings and suggest that frequent exposure to foods in childhood is critical in determining long-term liking for them.

Consistent with the hypothesized important role of exposure to foods in childhood on producing liking, we found that foods that were perceived as never or rarely eaten in childhood tended to show decreased hedonic ratings. Subjects reported currently disliking most vegetables and meats that they perceived they never tried or ate rarely in childhood. These foods are typically rejected by younger children because of neophobia (fear of something new) which typically peaks between 2 and 5 years of age (Cooke et al., 2003, 2006; Falciglia et al., 2000; Poelman & Delahunty, 2011). The effects of exposure were strong even for foods recalled as being disliked in childhood. For all food groups except for vegetables, disliked foods that were eaten at all, even if only rarely, in childhood were currently liked. Even occasionally consuming a food in childhood is

### Table 2

| Foods for which current liking was significantly impacted by parental practice. | Saw/encouraged more currently liked than indifferent | Saw/encouraged more currently liked than forced | Indifferent more currently liked than not allowed | Forced different from indifferent
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>High fat/high carbohydrate</td>
<td>Hash browns</td>
<td>Twinkies, chicken burger, cream-filled doughnuts, PBJ, milkshake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High carbohydrate</td>
<td>Chips and salsa, pancakes, smoothies</td>
<td>Hot dog, bacon, chicken nuggets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High fat</td>
<td>Bacon, cheese quesadilla</td>
<td>Whole milk, 2% milk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dairy</td>
<td>2% Milk, fat-free milk, 1% milk, parmesan cheese, chocolate milk, mozzarella cheese</td>
<td>Fat-free milk (forced more liked)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>Turkey</td>
<td>Beef, shrimp, roasted chicken</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit</td>
<td>Beef, shrimp, roasted chicken</td>
<td>Beef, shrimp, roasted chicken, (forced less liked)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>Cantaloupe, honey dew melon, pineapple, cherries, mango, raspberries, plums, kiwi fruit, grapes, strawberries</td>
<td>Cantaloupe, plums</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cauliflower, broccoli, spinach</td>
<td>Plums (forced less liked)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Foods that were significantly more currently liked when parents modeled or encouraged the consumption of foods than when parents were indifferent.
* Foods that were significantly more currently liked when parents modeled or encouraged the consumption of foods than when parents forced children to consume foods.
* Foods that were significantly more currently liked when parents were indifferent than when parents didn’t allow.
* Foods that were significantly less currently liked when parents forced than when parents were indifferent, except for fat-free milk.
Fig. 4. A–E. These figures display the average current liking for each food by parental practices. Note. Since there were no differences in current liking between watching parents eat (saw) and being encouraged by parents to eat (encouraged), responses to these variables are combined. In the figures above, “Encouraged” referred to “I was encouraged to eat this”; “Saw” was “I saw my parents eat this frequently”; “Indifferent” was “parents didn’t care if I ate”; “Not allowed” was “parents did not let me eat”, and “Forced” was “parents made me eat”. (A) Shows the high fat, high carbohydrate group, (B) shows high carbohydrate group (top) and high fat group (bottom) combined into one figure, (C) shows dairy (top) and proteins (bottom) combined into one figure, (D) shows fruits, and (E) shows vegetables.
### Effects of parental practices and attitudes

Foods that were perceived as being encouraged, allowed in moderation, and modeled by parents in childhood had higher current liking ratings as compared to other parental practices. Parental encouragement and modeling were particularly effective in increasing liking for foods that were reported as disliked in childhood. This was true even for strong-tasting foods such as vegetables. Encouraging and modeling the consumption of a variety of foods in childhood may be effective ways to instill long-term food preferences in children. Modeling and encouraging the consumption of foods have been shown to be positively associated with fruit, fruit juice, and vegetable intake in children and adolescents (Pearson et al., 2009).

Vegetables were most frequently reported in the “parents made me eat” category in all surveys. This is consistent with Batsell et al. (2002), who found that vegetables were the target food in more than 50% of forced consumption episodes in childhood. We observed for the majority of foods, other than vegetables and some meats, there was an increased liking for foods that were recalled as a target of force, consistent with previous studies (Vereecken, Keuleker, & Maes, 2004). On the other hand, subjects who recalled being forced to eat meats like beef, shrimp, and roasted chicken reported disliking those foods now more than if parents were indifferent. One possible explanation could be the nature of the food being forced. Possibly, the forced consumption of palatable foods such as fruits is not as vulnerable to the negative consequences of forced consumption as those that children generally dislike and are neophobic to, such as vegetables and meats ( Cooke et al., 2006; Falciglia et al., 2000). However, we did not use the word “forced” in our surveys which may relate to a different degree of persuasion than “made me eat”. Future studies should define the word “force” and then assess if a food’s palatability mediates the relationship between parental force and liking for foods.

Contrary to expectations, very few foods were selected for the “parents did not let me eat” variable, with the most common food being soda. The intake of carbonated beverages has been found to displace milk and calcium intake in children (Temple, 2009; Vartanian, Schwartz, & Brownell, 2007), perhaps prompting parental restrictions. Perceived recollections of parental restriction and never or rare consumption of soda in childhood were linked to lower current hedonic rating compared to those who recalled consuming soda frequently. In general subjects reported disliking foods they believed they were forbidden to eat as children. High fat/high carbohydrate (i.e., Twinkies, cream-filled doughnuts, peanut butter and jelly sandwich, chicken burger, milkshake), and high-fat (bacon, hot dog, chicken nuggets) foods were disliked by subjects who recalled that their parents did not allow them to eat these items as children. Consistent with these findings, De Bourdeaudhuij (1997) found that adults who recalled clear restrictions on unhealthy foods like French fries, soda, and desserts at an early age were more likely to report a lower intake of those foods than those not restricted. Additionally, Van der Horst et al. (2007) found that perceived parental restriction of sweetened beverages by adolescents were related to their lower consumption of those foods. One possible explanation is that adults dislike foods that were forbidden in the past because of negative experiences associated with eating those foods, such as guilt. Birch and Fisher (2000) showed that children displayed more negative emotions when eating foods that were forbidden by parents and suggest that forbidden foods may never lose their bad connotations. Alternatively, the restriction of these foods might have simply resulted in decreased childhood consumption, which lowered current liking due to the lack of exposure. This explanation seems most likely, as we observed here that recalled perceived frequency of consumption was extremely influential on current preferences, more so than parental attitudes.

Parental restriction of foods has shown the opposite effect when preference was measured when the subjects were still young. Children who were restricted from consuming certain foods showed greater liking and wanting to eat those foods than those not restricted ( Fisher & Birch, 1999, 2000; Jansen, Mulknens, Emond, & Jansen, 2008; Jansen, Mulknens, & Jansen, 2007; Patrick, Nicklas, Hughes, & Morales, 2005). It is possible either that foods often restricted by parents are those that are palatable to children or that they are seen as “special” due to their restricted status. Consistent with this interpretation, we found that subjects reported liking French fries, Popsicle, chocolate chip cookies, M&Ms, brownies, milkshake, cinnamon rolls, cheese pizza, and ice cream when they believed these foods were forbidden to them as children. Here again it seems likely that the effect of restriction is mediated by palatability.

We found that intake of foods that were perceived and recalled as not monitored closely by parents were liked by majority of subjects. Quite a few foods were more liked if “parents didn’t care if I ate” compared to “not allowed”, for example, chicken burger,
It is also likely that children whose parents did not monitor their consumption of these foods ate them more frequently than children whose parents did, resulting in an exposure effect.

Previous literature demonstrates the effects of availability and accessibility to foods on liking and consumption of those foods in children. For example, Cullen et al. (2003) showed that availability of food could explain 10% of the variance in food consumption and was the principal factor determining fruit and vegetable acceptance in adolescents. In this study, perceived recalled restricted availability of foods at home was not related to current liking for any food. Perhaps initial liking and intake of some foods may be affected by availability and accessibility to these foods in childhood, and then other factors become more influential as children grow older.

Methodological considerations

Self-reported retrospective survey responses can be biased by a number of factors, including memory salience, memory gaps, desire to conform to experimental expectations, and, in the case of food, desire to appear healthy. We asked college-aged adults to recall events and feelings associated with the consumption of various foods from many years ago. The validity and reliability of the obtained data was assessed by having a subsample of subjects and their parents answer the same questions about feeding practices in the home when the subjects were children. Although retrospective reporting has its weaknesses, it is reasonable to assume a low probability of the same events being misremembered by both parties separately. Due to the relatively good agreement of responses by both parents and their college-aged children, we suggest that self-reporting is a relatively accurate way of assessing events occurring in childhood.

It was surprising that subjects did not commonly report parental restrictions or forceful eating episodes. Since perception of restriction or force may vary based on parental style, we may have failed to capture the range of possible ways for foods to be restricted or forced. Future studies should measure the intensity of restriction by using a continuous response scale or giving descriptions of the many possible ways a food could have been restricted or forced.

Internal consistency between subject responses to the same food may have been high because the time gap between each asking was short (within the same survey administration). An improvement for future studies would be to assess internal consistency by repeated asking after a longer time gap, such as a repeated survey administration. Lastly, the survey was administered to college students enrolled in an introductory psychology course. The results may not generalize to other college students in the same age group.

Implications

Parental techniques to increase consumption and preference of a target food include creating a positive social environment, involving the child in preparation of the food, and reward for consumption (Casey & Rozin, 1989). Among the parental practices investigated in our survey, parental encouragement was the most effective practice in increasing adulthood liking for foods. In addition, frequency of exposure was found here to be the most influential contributor to the food preferences of college-aged adults. Perceived recalled consumption frequency was overwhelmingly associated with increased liking, and this effect was seen for disliked foods and nutritious foods, such as vegetables. Parents and caregivers should be aware that while neophobia may prevent foods from being accepted at first, continued exposure will instill a heightened preference that persists into adulthood.

Conclusions

Perceived recalled frequency of consumption of a food together with parental encouragement and modeling in childhood is influential in determining current preference in adults. Perceived recalled parental force and restriction have moderate effects, but they can be counterproductive and are heavily dependent on the palatability and energy density of the food. Overall, the influence of perceived recalled parental factors was overshadowed by frequency effects for all foods, including nutritious items such as cruciferous vegetables. College students’ liking of a food tends to increase when they remember eating it frequently in childhood, regardless of the parental context. An effective way to permanently ingrain food preferences is therefore to serve healthy foods frequently.

Appendix: Supplementary material

Supplementary data to this article can be found online at doi:10.1016/j.appet.2015.01.011.

References


D. Wadhera et al./Appetite 89 (2015) 22–32