A Retrospective Study on Changes in Food Preferences of Japanese High School Students from Childhood to the Present Day

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Received: May 13, 2017 Accepted: June 17, 2017 Online Published: July 28, 2017
doi:10.5539/jfr.v6n4p150 URL: https://doi.org/10.5539/jfr.v6n4p150

Abstract

Background: To conduct a retrospective study for investigating changes in food preferences of high school students from childhood to the present day. Methods: The study included 1,300 students aged 16–18 years who responded to a questionnaire regarding food items that they disliked at present and in their childhood; they selected a list of 55 foods and responded to 35 questions regarding their food habits. The distribution was categorized into four patterns of food preferences based on whether a particular student had disliked a particular food item during childhood (+) and during high school at present (+). Food preference at present was examined for all other items using logistic regression analysis after adjusting for gender and age. Results: In total, 66.9% of the subjects reported (+) to (+), 12.5% reported (+) to (−), 6.5% reported (−) to (+), and 14.1% reported (−) to (−). Even in the (+) to (+) group, a significant decrease was observed in the number of disliked foods from childhood (5.5 ± 5.4) to the present day (4.2 ± 4.1) (P < 0.001, ANOVA). No dislike for any food item at present was related to no dislike for any food item during childhood [odds ratio (OR), 12.57; 95% confidence interval (CI), 8.3–19.1] and talking positively about food (OR, 1.28; 95% CI, 1.11–1.49) but inversely related to the limited use of smartphone while eating (OR, 0.86; 95% CI, 0.75–0.98). Conclusion: Decreasing the dislike for foods at present as well as no dislike for any food item during childhood may be crucial for developing future good food habits in high school students. In addition, to improve current food preferences, students may need to eat together.

Keywords: food preferences, disliked food, high school students, childhood

1. Introduction

Early childhood is the most important period for establishing healthy eating habits and controlling the food preferences of children. Childhood is a crucial period for developing food acceptance patterns (Nicklas et al., 2001, Ilingworht & Lister, 1964, Cashidan, 1994). Some investigators have insisted that preferences are shaped by a combination of genetic and environmental factors (Wardle & Cooke, 2008). The development and long-term health of children is linked to food habits established from early childhood (Scaglioni et al, 2008). The correct food habits may continue in the future of children’s life. In addition, children are exposed to unhealthy food choices, which may have greatly contributed to the increase in the prevalence of overweight observed among their youth in the past several years (St-Onge MP, 2003). Therefore, it is important to take correct food habits during childhood.

On the other hand, adolescence is a crucial period for the development of health status (Mechanic & Hansell, 1987, Vingilis, Waed, & Seeley, 2002, Vingilis, Wade, & Seeley, 2007). During this period, health-related behaviors including smoking, alcohol consumption, drug use, nutrition-related behavior, and physical activities, are established (Sharma et al, 2016). Further, in this period, health is strongly affected by social factors, including income inequality, family support, school environment, and peer influence (Viner et al., 2012). The
food group consumption varies by socioeconomic, demographic, and life style factors in young adults (Deshmukh-Taskar P, 2007).

However, it is unclear how food preferences during childhood influence those during high school. In this retrospective study, we investigated changes in the food preferences of high school students from childhood to the present day.

2. Method

2.1 Participant (Subject) Characteristics

This was a cross-sectional study. From May to November 2015, 1,300 students aged 16–18 years from 11 high schools in Japan were included in the study. Of all students enrolled in the study, 1,296 (99.7%) completed and returned the questionnaire, and all provided informed consent for its use.

2.2 Questionnaire

The students answered a questionnaire regarding foods they disliked at present and in their childhood. They selected a list of 55 foods and answered 35 questions regarding their food habits.

This questionnaire is a revised version of the one originally created by the Japan Sports Council that was used to determine the food habits of high school students (Japanese Sports Council, 2010, Osera et al., 2016a). Further questionnaire items addressed ‘respect for food’, utilising a 5-point rating scale. In addition, Self-rated health (SRH) measures generally included questions, such as “How would you rate your overall health?,” and offered five response categories that ranged from excellent to poor: Excellent, Very good, Good, Fair, and Poor (Joffer et al., 2016, Warnoff, et al., 2016, Wu et al, 2013).

The foods student disliked, which were chosen by themselves from a list of 55 foods; Noodle, Rice, Bread, Konjaku, Sweet potato, Potate, Azuki beans, Soybeans, Freeze-dried tofu, Tofu, Deep-fried tofu, Sesame, Pampkin, Peas, String beans, Carrot, Leak, Green pepper, Broccoli, Spinach, Japanese mustard spinach, Cabbage, Cucumber, Burdock, Japanese radish, Onion, Corn, Eggplant, Chinese cabbage, Tomato, Cherry tomato, Banana, Tangerine, Apple, Pineapple, Enoki mashroom, Shimeji mashroom, Dried shitake, Toasted laver, Hijiki, Seaweed, Squid, Shrimp, Fish paste cake, Spanish mackerel, Sermon, Liver, Beef, Chicken, Pork, Cheese, Yogurt, Milk, Egg, Quail egg. The foods on the list were selected from what were available at regular school lunches and often disliked by children as shown in our previous study (Osera et al, 2016a).

The distribution was categorized into four patterns of food preferences based on whether a particular student had disliked a particular food item during childhood (+) or not (−), and during high school days at present (+) or not (−). For example, (+) to (−) means that the student disliked some foods during childhood while as high school students they had no dislikes, (+) to (+) means that the students disliked some foods as childhood and that they disliked some foods as high school days, (−) to (+) means that the students disliked no foods as childhood and that as high school days they disliked some foods, (−) to (−) means that the students disliked no foods as childhood and that they disliked no foods as high school days.

2.3 Statistics and Data Analysis

The analysis of variance (ANOVA) was used to compare each number of disliked foods between the time of childhood and at present groups in they have food preference. The chi-square test or Fisher’s exact test was used to evaluate associations between independent variables and food preferences at the time of childhood and at high school age. McNemar test was used to assess the food preferences change from childhood to high school age. The percentage of high school students who disliked each food was significantly different from that of them in childhood. A probability (P) value < 0.05 was considered statistically significant (Figure 2).

All significant variables in the bivariate analysis were then entered into a logistic regression analysis. Food preference at present, the differences between those that disliked foods at present and they those that did not dislike any food at present, were examined for all the other items using logistic regression analysis after adjusting for gender and age. A dichotomy regression analysis was performed by setting a stepwise method. The sample data were entered and analyzed using SPSS for Windows, Version.23 (IBM, New York, NY).

2.4 Ethics

Students were informed as to the objects and methods of this study and answered the questionnaire only if they so desired, in the absence of any compelling force and with the right of free withdrawal. Individual privacy was strictly protected thorough the investigation. This study was approved by the leader of the high school. Under these conditions, students agreed with their corporation for the scientific investigations in the high schools, including this study, when their students entered. This study was approved by the Kobe Women’s University
Ethics Committee Regarding Human Subjects.

3. Results

3.1 Relationship between Food Preferences and Physical Characteristics, Self-Rated Health

Fisher’s exact probability test and ANOVA revealed that the relationship between food preferences in childhood and at high school age and physical characteristics, self-rated health was statistically significant (Table 1). In males, a relationship between height, weight, and food preferences in childhood was observed (P < 0.001); however, such a relationship was not observed at high school age (P = N.S). Notably, no significant difference was observed in BMI in either gender during childhood and at high school age (Table 1).

3.2 Relationships between Food Preferences during Childhood to High School Age

Fisher’s exact probability test revealed that the relationship between food preferences in childhood and current food preferences by gender was statistically significant (Table 2). In total, about 30% of the students answered “I do not know” or “I do not remember.” In total, 66.9% of subjects reported (+) to (+), 15.7% reported (+) to (−), and 14.1% reported (−) to (−) (Table 3). Significant differences by age were observed.

Table 1. Comparison in characteristics of high school students between presence and absence of preferences

<table>
<thead>
<tr>
<th>Variable</th>
<th>During childhood</th>
<th>The present day</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Presence (+)</td>
<td>Absence (−)</td>
<td>Presence (+)</td>
</tr>
<tr>
<td>Height (m)</td>
<td>665 161.1±8.2 167 165.0±8.9 0.000***</td>
<td>857 161.5±8.2 308 165.1±8.5 0.000***</td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>615 54.3±9.2 158 57.3±11.1 0.000***</td>
<td>791 54.1±9.4 297 56.4±10.2 0.000***</td>
<td></td>
</tr>
<tr>
<td>BMI (m/kg²)</td>
<td>661 20.5±2.5 157 20.9±2.8 N.S</td>
<td>791 20.6±2.7 296 20.6±2.9 N.S</td>
<td></td>
</tr>
<tr>
<td>Height (m)</td>
<td>280 169.2±6.3 88 171.3±6.7 0.006</td>
<td>311 169.4±6.1 214 170.4±6.4 N.S</td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>277 59.7±9.3 88 63.0±11.0 0.006**</td>
<td>310 60.3±9.9 173 60.5±9.9 N.S</td>
<td></td>
</tr>
<tr>
<td>BMI (m/kg²)</td>
<td>277 20.8±2.8 87 21.3±3.2 N.S</td>
<td>309 21.0±3.0 172 21.0±3.0 N.S</td>
<td></td>
</tr>
<tr>
<td>Height (m)</td>
<td>358 156.9±5.0 79 158.1±5.0 N.S</td>
<td>484 153.9±5.3 134 151.8±5.1 0.000</td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>338 49.9±6.3 70 50.3±6.0 N.S</td>
<td>481 50.1±6.5 124 50.2±6.6 N.S</td>
<td></td>
</tr>
<tr>
<td>BMI (m/kg²)</td>
<td>339 20.2±2.5 70 20.2±2.1 N.S</td>
<td>482 20.3±2.5 124 20.1±2.6 N.S</td>
<td></td>
</tr>
</tbody>
</table>

Distribution of BMI

| Over 25.0 | 27 4.4% | 8 5.1% | 16 5.4% | 41 5.2% |
| All 18.5-25.0 | 479 77.8% | 130 82.8% | N.S | 228 77.0% | 610 77.1% | N.S |
| Under 18.5 | 110 17.9% | 19 12.1% | 52 17.6% | 140 17.7% |

Self-rated health

| Excellent | 236 34.4% | 102 58.3% | 301 33.9% | 157 48.6% |
| Very good | 328 47.8% | 51 29.1% | 441 49.6% | 112 34.7% |
| Good | 76 11.1% | 13 7.4% | 0.000*** | 87 9.8% | 33 10.2% | 0.000*** |
| Fair | 40 5.8% | 8 4.6% | 53 6.0% | 18 5.6% |
| Poor | 6 0.9% | 1 0.6% | 7 0.8% | 3 0.9% |

Note. Significance tested using a Fisher’s exact probability test; * p < 0.05, ** p < 0.01, *** p < 0.001 Significance tested using a t-test; + p < 0.05, ++ p < 0.01, +++ p < 0.001 ‘Presence’ (+) means that students dislike more than one foods, ‘Absence’ (−) means that students disliked no food.

Even in the (+) to (+) group, a significant decreased was observed in the number of disliked food items from childhood (5.5 ± 5.4) to the present day (4.2 ± 4.1) (P < 0.001, ANOVA; Figure 1). In male, a significant decreased was observed in the number of disliked food items from childhood (4.8 ± 4.9) to the present day (3.6 ± 4.0) (P < 0.001, ANOVA; Figure 1). In female, a significant decreased was observed in the number of disliked food items from childhood (6.0 ± 5.7) to the present day (4.5 ± 4.0) (P < 0.001, ANOVA; Figure 1).
Table 2. Relationship between during childhood and at present by gender

<table>
<thead>
<tr>
<th></th>
<th>Presence (+)</th>
<th>Absence (−)</th>
<th>I do not know</th>
<th>I did not remember</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>284 (51.9)</td>
<td>92 (16.8)</td>
<td>44 (8.0)</td>
<td>127 (23.2)</td>
<td>0.016*</td>
</tr>
<tr>
<td>Female</td>
<td>405 (53.9)</td>
<td>83 (11.1)</td>
<td>80 (10.7)</td>
<td>183 (24.4)</td>
<td></td>
</tr>
</tbody>
</table>

Note. The relationship between preference and gender were assessed using a Fisher’s exact probability test; * p < 0.05, ** p < 0.01, *** p < 0.001 ‘Presence’ (+) means that students dislike more than one foods, ‘Absence’ (−) means that students disliked no food.

Table 3. Student’s preference of during childhood to high school in relation with gender

<table>
<thead>
<tr>
<th></th>
<th>(+)→(+), N (%)</th>
<th>(+)→(−), N (%)</th>
<th>(−)→(+), N (%)</th>
<th>(−)→(−), N (%)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>213 (59.7)</td>
<td>54 (15.1)</td>
<td>23 (6.4)</td>
<td>67 (18.8)</td>
<td>0.000***</td>
</tr>
<tr>
<td>Female</td>
<td>345 (72.3)</td>
<td>50 (10.5)</td>
<td>31 (6.5)</td>
<td>51 (10.7)</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>558 (66.9)</td>
<td>104 (12.5)</td>
<td>54 (6.5)</td>
<td>118 (14.1)</td>
<td></td>
</tr>
</tbody>
</table>

Note. Food preferences of children during childhood to high school in terms of gender were assessed using Fisher’s exact probability test; * P < 0.05, ** P < 0.01, *** P < 0.001

(−) means that students disliked no food, (+) means that students dislike more than one foods, (+) to (+), means that the students disliked some foods as childhood and that they disliked some foods as high school days, (+) to (−), means that the students disliked some foods as childhood and that as high school days they disliked no foods, (−) to (+), means that the students disliked no foods as childhood and that as high school days they disliked some foods, (−) to (−), means that the students disliked no foods as childhood and that they disliked no foods as high school days.

Figure 1. Relationship between the number of their disliked food childhood and high school

Note. The number of their disliked food during childhood to high school in terms of gender were assessed using two way ANOVA; * P < 0.05, ** P < 0.01, *** P < 0.001

The foods student disliked, which were chosen themselves from a list of 55 foods.
3.3 Relationships between Food Preferences during Childhood to High School Age

The students’ food preferences at present and in childhood exhibited significant relevance for 18 types of vegetables, three types of mushrooms, three types of seafood, and two types of beans (P < 0.001, by McNemar test). However, grains, fruits, and meat group were not significantly relevant. Green pepper (41.8%) was the food preference with the highest improvement rate of 23.8%. Liver and shrimp topped the list of disliked food items reported by the students, but did not exhibit significant changes in preference compared to childhood. In childhood, the top five most disliked foods were green pepper (41.8%), peas (41.6%), liver (40.7%), eggplant (40.0%), and dried mushroom (32.3%). The highest rate was liver 38.8%. Liver exhibited significant changes from childhood to high school age. Now, in high school, the number of disliked food items decreased; green pepper (23.8%), eggplant (17.9%), and peas (17.3%) had the highest improvement rates (P < 0.001). The most disliked food was vegetables in both childhood and in high school. If children dislike some types of food, when they grow up, they may be improving their preferences (Figure 2).

Figure 2. In the detail of each food, relationship between their disliked food childhood and high school.

Note. The percentage of food preferences of children during childhood to high school were assessed using the foods student disliked, which were chosen themselves from a list of 55 foods. McNemar test; * P < 0.05, ** P < 0.01, *** P < 0.001
3.4 Multiple Logistic Regression Analysis of Factors Affecting Students’ Preferences

No dislike for any food item at present was related to no dislike for any food item during childhood [odds ratio (OR), 12.57; 95% confidence interval (CI), 8.3–19.1], talking positively about food (OR, 1.28; 95% CI, 1.11–1.49), but inversely related to limited use of smartphone while eating (OR, 0.86; 95% CI, 0.75–0.98) (Table 4).

Table 4. Means and 95% confidence intervals of food habits based on current preferences in the high school students after covariate adjustment

<table>
<thead>
<tr>
<th></th>
<th>OR</th>
<th>(95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No dislike for any food item during</td>
<td>12.57</td>
<td>(8.29, 19.05)</td>
<td>0.000</td>
</tr>
<tr>
<td>childhood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Talking about food</td>
<td>1.28</td>
<td>(1.11, 1.49)</td>
<td>0.013</td>
</tr>
<tr>
<td>Limited use of smartphone while eating</td>
<td>0.86</td>
<td>(0.75, 0.98)</td>
<td>0.022</td>
</tr>
</tbody>
</table>

OR, Odds ratio; CI, confidence interval. Multiple regression analysis by setting a stepwise method

‘Talking about food’ increases if students talk with their family during meals. Adjusted for gender and age.

4. Discussion

According to Tables 1 and 2, food preference influences on health, exhibiting significant differences by gender at high school age. A relationship between height, weight, and food preferences in childhood was observed (P < 0.001). It is important evidence to correct food preference during childhood. In addition, SRH is a measure of the relationship between during childhood and high school age. The utility of SRH assessments has been shown in persons with moderate-to-severe chronic kidney disease (Robinson-Cohen et al., 2014). SRH assessment among adolescents is a good measure of enduring self-concepts of health. It is strongly associated with general well-being and psychosomatic symptoms (Vingilis, Waed, & Seeley, 2002, Boardman, 2006, Breidablik, Meland, & Lydersen, 2008, Piko, 2007). SRH was also influenced by gender, family support, lifestyle and psychological factors (Sharif et al., 2016). The result revealed that children’s preferences in childhood may be connected with their health when they are at high school age.

In total, 66.9% of subjects reported (+) to (+), 12.5% reported (+) to (−), 6.5% reported (−) to (+) and 14.1% reported (−) to (−) (Table 3). A previous study on children aged 4–6 years in kindergartens revealed similar trends (Osera et al., 2014). The changes in the people’s food preference are almost same percentages in childhood and childhood to high school ages.

No dislike for any food item at present was related to no dislike for any food item during childhood (OR, 12.57; 95% CI, 8.3–19.1), talking positively about food (OR, 1.28; 95% CI, 1.11–1.49), but inversely related to limited use of smartphone while eating (OR, 0.86; 95% CI, 0.75–0.98) (Table 4). “Talking about food” and “limited use of smartphone while eating” may be connected with cultural upbringing. Three previous studies of ours suggested that mothers’ attitude toward food and eating may have profound effects on children’s food preferences (Osera et al., 2012, Osera et al., 2016b). At high school age, it may be important that home and family food environment is similar to that as in childhood. In most cases, the mothers make the dinner (data not shown). So, the mother’s role is very important. “Talking about food” rephrase “they eat together.” Studies have shown that the meal pattern of skipping breakfast or having “breakfast and lunch together” is related to a less healthy lifestyle and food choices leading to a poorer nutritional intake (Sjoberg et al., 2003). In addition, Stratton described that eating together with the family at meal time was very important for children’s development (Stratton, 2003). Taken together, it is suggested that eating while talking to the family positively affects food preference at high school age.

In addition, using smartphones is associated with several obesity risk factors (Kenny & Gortmaker, 2017). Another researcher suggested that depression, anxiety, and daytime dysfunction scores were higher in the high smartphone use group than in the low smartphone use group (Demirci et al., 2015). Therefore, it is suggested that long time using smartphones is related with not only food preferences but also health.

Figures 1 and 2 show that the number of preferences may decrease from childhood to high school age. In the (+) to (+) group, a significant decrease was observed the number of disliked foods from childhood to the present day by gender. Our data described that female have the number of their disliked food over male. The finding corresponds with the previous data about gender influences on food preferences reported by Caine-Bish and Scheule (2009). Gender differences should be considered (Figure 1).

In addition, green pepper and eggplant could be changed (Figure 2). People whose diet comprises more vegetables and fruits have greater longevity and are also protected from heart disease and cancer Bazzano LA (2006). Eating fruits and vegetables has been found to help prevent illness such as cancer and obesity (Ness &
Powles, 1997). The more children are exposed to a variety of vegetables, the more likely they are to like those vegetables (Birch & Marline, 1982). Therefore, it is good for children and adolescents to eat vegetable. According to Figure 1 and Figure 2, as they grew up, their disliked food may be decreased. If children and high school students would like to reduce dislike of food, we found that when the children’s “Respect” and “Concern” levels increased, the percentage of children who disliked each of the top 10 disliked foods significantly decreased, showing a similar tendency in the number of foods which children disliked in relation to “Respect” and “Concern” reported by others (Osera et al., 2016a). Importantly, during high school age, children may decrease their preference especially for vegetables.

There are several inherent limitations of the present analysis. A limitation of the current study is that about 30% of the students answered “I do not know” or “I do not remember.” It was also a limitation that it was a retrospective study due to recall bias. In addition, we only reported associations. We could not clearly demonstrate a cause and effect relationship. This study suggested a relationship between children’s food preference and subsequent high school SRH and height and weight in males, but we do not know the strength of the health effects. In the next study, we will try to do the investigation or cohort study.

In conclusion, less dislike for certain foods in high school students was related to eating with somebody at present day as well as a lower number of dislike food items in childhood. Decreasing the dislike for foods at present as well as no dislike for any food item in childhood may be critical to developing good food habits in the future of high school students.

Acknowledgments

We thank all the students and teachers in Japan for their contributions to this study. We are also grateful to the teachers for their assistance.

Author contributions

Tomoko Osera, Setsuko Tsutie, and Nobutaka Kurihara developed the standardized protocol and structured questionnaire. Mitsuyo Awai, Misako Kobayashi conducted the focus group research in the high school. Tomoko Osera drafted the manuscript. All authors critically revised the article for important intellectual content and approved the final manuscript.

Conflict of interest

The authors declare that they have no conflict of interest.

References


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