**Research Article**                                                                                    **Open Access**

# Associations between Children's Food Preferences and Food Habits towards Healthy Eating in Japanese Children

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## Abstract

**Background:** Food-related preferences and practices are essential for nutrition and are formed in early childhood. In this study, we investigated the associations between the frequency of food dislikes of children at 3-5 years old and their attitudes toward healthy eating.

**Methods:** In February 2012, a questionnaire was given to the mothers of 928 children who attended eight kindergartens or nursery facilities in Japan. In the questionnaire, the mothers were asked about their children's food behaviors and attitudes including whether they have disliked food. The mothers also answered the foods that the children disliked, which were chosen from a list of 55 foods. We analyzed the data with the structural equation model to examine the mutual relationships of the questionnaire items. Then, we investigated the association of the frequency of the children's food dislikes with their levels of "respect for food" and "concern about food" on the basis of the results of the structured equation model analysis.

**Results:** The structural equation model showed that "respect for food", "concern about food" and their preferences were classified into the same category. In the model, "respect for food" and "concern about food" and their preferences affected morning habits, sleeping habits, meal preparation, and communication with their family (GFI=0.97; AGFI=0.95; CFI=0.93; RMSEA=0.05). The number of foods disliked by the children significantly decreased according to increasing levels of "respect for food" (p<0.001) and "concern about food" (p<0.001). The ratio of each of the top 10 foods which children disliked decreased significantly as the level of "respect for food" and "concern about food" increased respectively.

**Conclusion:** The present data suggested that the children's "respect for food" and "concern about food" were associated with a decrease in children's food dislikes.

**Keywords:** Children's preferences; "Respect for food"; "Concern about food"

## Abbreviations:

GFI: Goodness of Fit Index; AGFI: Adjusted Goodness of Fit Index; CFI: Comparative Fit Index; RMSEA: Root-Mean Square Error of Approximation; Respect: Respect for Food; Concern: Concern about Food; SD: Standard Deviation; N.S: Not Significant.

## Introduction

Early childhood is the most important time for establishing eating habits and developing tastes. In the early years of life, food likes and dislikes are the primary determinants of food intake [1,2]. People whose diet comprises more vegetables and fruits have greater longevity and are also protected from heart disease and cancer [3]. We surmised that it would be important for a healthy life that people consume various foods. Perez-Rodrigo et al. [4]. Demonstrated a significant relationship between likes/dislikes for fruits and vegetables and the

regular consumption of items from this food group among children and young people. Thus, children's food preferences are very significant for their health. In addition, the food group consumption varies by socioeconomic, demographic, and life style factors in young adults [5]. The development and long-term health of children are linked to food habits from early life onward [6]. Therefore, the correct food habits may continue in the future of children's life. On the other hand, 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 [7]. Therefore, it is important to take correct food habits during childhood.

In this study, we attempted to examine how children's food preferences and food habits were influenced by their food habits using a covariance structure analysis. In addition, since the analysis showed that children's preferences were associated with their responses to "respect for food" and "concern about food" in this study, we also analyzed the direct relationship of children's concern about food and respect for food with their food preferences.

## Methods

This study was a cross-sectional and the test-retest reliability study. In February and March 2012, a questionnaire was given to the mothers of 928 children aged 3-5 years who attended two private kindergartens, four public kindergartens, or two private nursery schools in Japan. The mothers voluntarily cooperated on the questionnaire survey. They may choose not to take the survey, to stop responding at any time, or to skip any questions that they do not want to answer. However, once they submitted the questionnaire, they could not withdraw it, because the questionnaires were filled out anonymously. Only after they agreed to these, we asked them to cooperate on the survey. Individual privacy was strictly protected throughout the investigation. This study was conducted after approval by the principals of all kindergarten and nursery facilities as well as by the committee which deliberated at that time on important affairs including research ethics in Kobe Women's University attached to Takakuradai Kindergarten before the start of this study. Of the mothers recruited for participation, 743 (80.1%) returned the completed questionnaire, and all of them gave informed consent for its use. Incomplete data from 55 mothers were excluded from the analysis.

In March and April 2012, a questionnaire was given to the mothers of 142. The mothers filled in two identical questionnaires with a 1 month interval. The questionnaires were administered in the classroom while a member of the research team was present in March-December 2012. Of the 142 mothers invited to participate, 142 (100%) returned informed consent forms from parents and completed the forms at both times. This study was conducted after approval by the principals of all kindergarten and nursery facilities as well as by the committee that deliberated at that time on important affairs including research ethics in Kobe Women's University attached to Takakuradai Kindergarten before the start of this study.

**The questionnaire for the mothers consisted of two parts:** (1) their children's food habits and lifestyle including behaviors and attitudes as shown in Table 1. This questionnaire has five section and 11 questions; Sleeping habits has 2 questions, Morning habits has 2 questions, Social environment has 4 questions, Attitude and Preferences has 3 questions. The questionnaire was developments by the theory of planned behavior (TPB) and Social Cognitive Theory [8,9]. (2) The foods their children disliked, which were chosen by the mothers from a list of 55 foods. 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 [10].

**Table 1.** Reliability of items and scales measuring determinants of associations between children's food preferences and food habits.

| | Construct with item(s) | Range | Average of answer | | | Internal consistency, Cronbach's $\alpha$ | Test-retest reliability, ICC |
|---|---|---|---|---|---|---|---|
| Sleeping habits | Wake-up time [1] | 1 − 4 | 3.3 | ± | 0.6 | 0.53 | 0.88 |
| | Go-to-bed time [1] | 1 − 4 | 2.3 | ± | 0.7 | | |
| Morning habits | Eating breakfast [2] | 1 − 4 | 4.0 | ± | 0.2 | 0.14 | 0.56 |
| | Eating together with mother at breakfast [2] | 1 − 5 | 3.2 | ± | 1.0 | | |
| Social environment (meal prepareation) | Helping make the dishes [2] | 1 − 5 | 4.0 | ± | 1.1 | 0.59 | 0.84 |
| | Helping set the table [2] | 1 − 5 | 4.0 | ± | 0.9 | | |
| (communication with their family) | Talking about food [2] | 1 − 5 | 3.9 | ± | 0.9 | 0.68 | 0.79 |
| | Talking about taste [2] | 1 − 5 | 4.0 | ± | 0.8 | | |
| Attitudes | Concern about food [2] | 1 − 5 | 3.8 | ± | 0.9 | 0.53 | 0.59 / 0.83 |
| | Respect for food [2] | 1 − 5 | 3.7 | ± | 0.9 | | |
| Preferences | Having likes and dislikes [3] | 0 − 1 | 0.8 | ± | 0.4 | | 0.89 |

1) The earlier the time was, the higher point mothers selected.

2) The more often the behavior was performed, the higher point mothers selected.

3) If a child had disliked more than one food, the mother selected "1."

4) N=743

5) N=142

Cronbach's α coefficients were computed to measure the internal consistency of the scales, values of α larger than 0.50 were considered acceptable [11]. Single measure intra-class correlation coefficients (ICCs) were used to explore the test-retest reliability with the test-retest interval. Coefficients in the range of 0.60-0.80 can be considered as reflecting good test-retest reliability, while values ranging from 0.81 to 1.00 are excellent [12,13].

Structural equation modeling was used to explore more complex food habit associations. The following fit indices were used to assess the model fit: goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI), and root-mean square error of approximation (RMSEA). GFI, AGFI, and CFI are considered a good fit when they are higher than 0.9. RMSEA is a good fit when it is not above 0.05. The data were analyzed using Amos® software version 6.0 (IBM, New York, NY).

Because structural equation modeling analysis revealed that children's "respect for food (Respect)" and "concern about food (Concern)" significantly related to their preferences, we analyzed their preferences at each of their ranks of these items. The answers to these items were classified into three levels, by which children's food behaviors including preferences, or likes/dislikes, were compared. In addition, from children's disliked food which their mothers had chosen, we chose the top 10. We investigated the ratio of children who disliked each of the top 10 foods by the three levels of "Respect for food," and "Concern about food". The Kruskal-Wallis test and Bonferroni-corrected Mann-Whitney U-test were used to compare them as well as two-sided P values using the program SPSS version 19.0 J (IBM, New York, NY).

## Results

### Characteristics of the answers for the questions related to food habits

Overall responses for the questionnaire items related to food habits and lifestyle are shown in Table 1. A total of 741 questionnaires were analyzed, which included the answers from the mothers of 147 3-year-old-class children, 249 4-year-old-class children, and 345 5-year-old-class children: the mean age of the children was 4.3 ± 0.8 (mean ± SD) years, and 49.4% of the children of the participants were boys and 50.6% of those were girls (P=N.S., boys vs. girls).

### Internal consistency of scale and Test-retest reliability

Table 1 report Croncach's α values respectively. Croncach's α than 0.50 was found four categories. In morning habits, a considerably lower α value (α=0.14) was found. For the total sample, test-retest reliability was good to very good (ICC>0.60). The two categories, Sleeping habits and Social environment (meal preparation, communication with their family), was good to very good (ICC>0.60). ICCs for the other constructs ranged between 0.50 and 0.59 indicating that no unacceptably low reliability coefficients were detected for the samples. The two categories, Morning habits and Attitude/Preferences was low reliability (ICC>0.50).
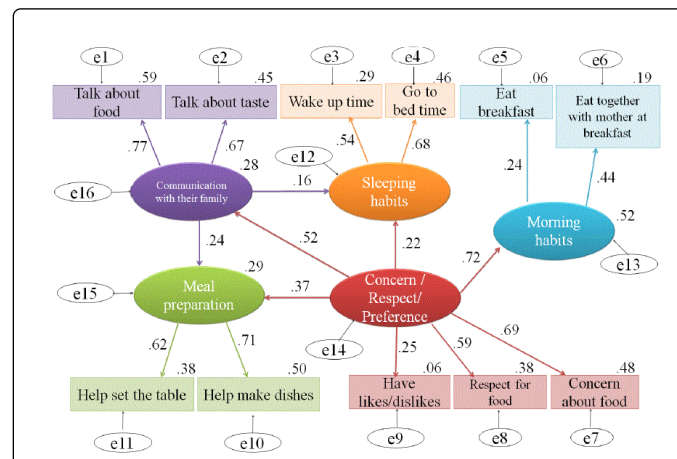
### The structural equation model for children's food habits

Figure 1 presents the results for this model. The overall fit of the model was evaluated as very good (GFI=0.97; AGIF=0.95; CFI=0.93; RMSEA=0.05, Figure 1). The structural equation model showed five categories. In a category, the children's "Concern about food (Concern)," "Respect for food (Respect)," and "Have likes/dislikes (Preferences)" were in the same category. "Concern/Respect/Preference" associated with other four categories: "Morning habits," "Sleeping habits," "Meal preparation," and "Communication with their family." These categories significantly related each other, except that "Morning habits" was significantly associated only with "Concern/Respect/Preference" but not with other categories.

### Children's preferences in three groups of "Respect" and "Concern" levels

Of all the children, 74.6% had some food dislikes. When we observed the children's preferences among the three levels of "Respect for food," children in the low "Respect" level group had significantly more dislike food compared with the middle and high "Respect" level

groups (7.4 ± 6.7 vs. 5.6 ± 5.4 and 4.0 ± 3.7 items, mean ± SD, p<0.001, Table 2). As for "Concern about food" children in the low "Concern" level group had significantly more dislike food compared with the middle and high "Concern" level groups (6.2 ± 6.7 vs. 4.1 ± 5.1 and 2.9 ± 5.6 items, mean ± SD, p<0.001, Table 3). Thus, the number of foods which children disliked decreased significantly as the level of "Respect for food" and/or "Concern about food" increased.



**Figure 1:** Structural Equation Model for Children's Concern, Preferences, and food habits. In this exploratory model of the factors associated with children's food habits, the sizes of associations were indicated by the standardized regression coefficients (range, −1.0–+1.0). This model was created containing all possible associations between the displayed variables, after that all non-significant arrows (P ≥ 0.05) were removed. The model also contained all other variables entered in the multivariate model. The overall model fit was valid.

**Table 2. Average of the number of disliked food among the three level of respect for food.**

| Respect for food | N | Mean | SD | | |
|---|---|---|---|---|---|
| Low Respect | 232 | 7.4 ± 6.7 | | ### | ### *** |
| Middle Respect | 241 | 5.6 ± 5.4 | | | |
| High Respect | 81 | 4.0 ± 3.7 | | N.S. | |

***, *p* < 0.001 by Kruskal-Wallis test

###, *p* < 0.001 by Bonferroni-corrected Mann-Whitney U-test

SD: standard deviation

N.S.: not significant

**Table 3. Average of the number of disliked food among the three level of concern about food.**

| Concern about food | N | Mean | SD | | |
|---|---|---|---|---|---|
| Low Concern | 200 | 6.2 ± 6.7 | | ### | ### *** |
| Middle Concern | 241 | 4.1 ± 5.1 | | | |
| High Concern | 112 | 2.9 ± 5.6 | | N.S. | |

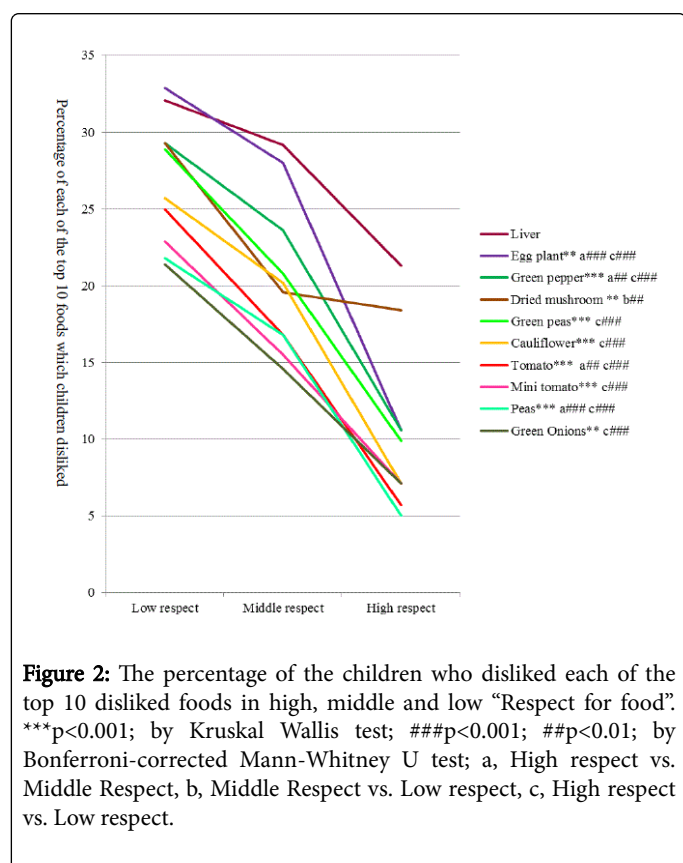***, *p* < 0.001 by Kruskal-Wallis test

###, *p* < 0.001 by Bonferroni-corrected Mann-Whitney U-test

SD: standard deviation

N.S.: not significant

The ratio of children who disliked each of the top 10 disliked foods in three groups of "Concern" and "Respect" levels.

Mothers chose the foods which their children disliked from a list of 55 foods. The ratio of children who disliked each of the top 10 foods was investigated. Figures 2 and 3 showed that when the children's "Respect" and "Concern" levels increased, the percentage of children who disliked each of the top 10 disliked foods significantly reduced (p<0.001, each). This shows the same tendency with the number of foods which children disliked in relation to "Respect" and "Concern" shown above in (Tables 2 and 3).
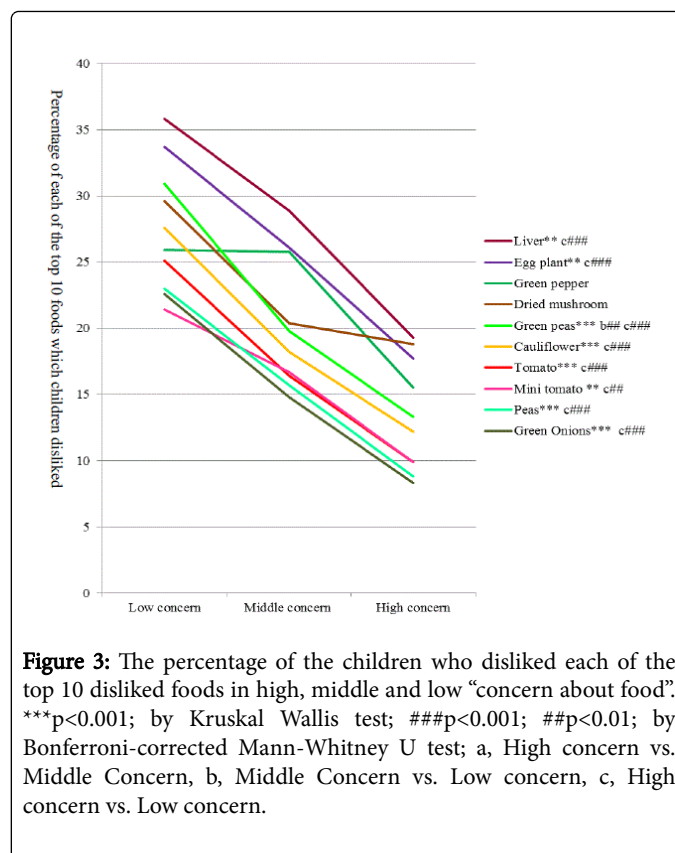


**Figure 2:** The percentage of the children who disliked each of the top 10 disliked foods in high, middle and low "Respect for food". ***p<0.001; by Kruskal Wallis test; ###p<0.001; ##p<0.01; by Bonferroni-corrected Mann-Whitney U test; a, High respect vs. Middle Respect, b, Middle Respect vs. Low respect, c, High respect vs. Low respect.

## Discussion

### To test the internal consistency of scale and Test-retest reliability

This questionnaire had internal consistency of scale and Test-retest reliability that was based on TPB and Social Cognitive Theory [8,9] (Table 1). The study revealed that the instrument developed to measure associations between children's food preferences and attitudes toward healthy eating shoed moderate to good test-retest reliability for all constructs, and moderate to good internal consistency for the scales with exception of Morning habits. De Bourdeaudhuij et al. showed that the questionnaire based on TPB and Social Cognitive Theory provides a reliable, valid and administer tool for assessing social and environmental factors of potential influence on fruit and vegetable intake in children [14]. The result revealed that the questionnaire might use to assess associations between children's food preferences and attitudes toward health eating.

Associations between children's food preferences and attitudes toward healthy eating as demonstrated by the structural equation model.



**Figure 3:** The percentage of the children who disliked each of the top 10 disliked foods in high, middle and low "concern about food". ***p<0.001; by Kruskal Wallis test; ###p<0.001; ##p<0.01; by Bonferroni-corrected Mann-Whitney U test; a, High concern vs. Middle Concern, b, Middle Concern vs. Low concern, c, High concern vs. Low concern.

Likes and dislikes are the primary determinants of food intake. This study analyzed the associations between children's food preferences and attitudes toward healthy eating in 3 to 5-year-old children using the structural equation model (Figure 1). We found the close relationship of children's preferences to "Respect for food" and to "Concern about food" in the model, because the structural equation model showed that preference and these two items were classified in to the same category. Grol et al. reported that human behavior is a complex process determined by knowledge about attitudes toward behavior and self-efficacy [15,16]. In addition, our previous retrospective cohort study showed changes in children's likes/dislikes during kindergarten 2 years' course was related to "Respect for food" [17]. Therefore, children's attitudes including respect and concern may affect their preferences.

In the structural equation model, the children's "Concern/Respect/Preference" was associated with four categories (Figure 1). It showed that high "Concern/Respect/Preference" was related with their appropriate life style. One of the four categories was "Morning habits". Since skipping breakfast was reported to reduce children's appetite [18], morning habits are related with appetite. The meal pattern of skipping breakfast or having "breakfast and lunch together" was related to less healthy lifestyle and food choices leading to a poorer nutritional intake [19]. While, eating breakfast every day led to a healthy body weight [20]. Breakfast frequency and quality may be related to causal ways of appetite and blood sugar control [21]. Accordingly, children's "Morning habits" may be related with not only preference but also their health.

The four categories also included "Sleeping habits." Westerlund reported that sleeping habits are associated with food consumption

patterns. Shorter sleep duration during school nights is associated with higher consumption of energy-rich foods in school children [22]. Children, who had good "Sleeping habits" or slept early and got up early, may have enough time to eat breakfast each morning. Our result showed that this appropriate life style may decrease the number of disliked foods.

Another category was "Talk with family." Stratton described by that eating together with the family at mealtime was very important for children's development [23]. Taken together, it is suggested that children's eating while talking to their family positively affects their respect, concern, and preference about food.

The other category that was associated with "Concern/Respect/ Preference" was children's "Meal preparation." Other researchers suggested that "Meal preparation" was associated with the amount of housework the children completed, which has been associated with good health in adults [24]. Children would continue to do housework as an adult if they did housework during childhood. It goes without saying that guardians play a very important role in establishing food habits and life style in early childhood [6,10,25]. Thus, "Meal preparation" may be very important to have "Concern/Respect/ Preference" during childhood.

The number of disliked foods and the ratio of children who disliked each of the top 10 foods, by three levels of "Respect" and "Concern".

The ratio of children who disliked each of the top 10 foods decreased significantly as the level of "Respect for food" and "Concern about food" increased (Figures 2 and 3). These results suggested that "Respect" and "Concern" were associated with children's food dislikes. As mentioned earlier, our previous retrospective cohort study showed changes in children's likes/dislikes was related to "Respect for food" [17]. In addition, other researchers have revealed the relationship between the concern about food and the consumption of traditional foods [26]. These findings suggest that that the foods disliked by children are reduced with high "Respect for food" and high "Concern about food". This connected with the results of analysis with structural equation model (Figure 1). Since these attitudes for food can be modified, they may have a key role of improving children's food preferences.

## Study Limitations

The study has some potential limitations. Because it was very difficult to obtain the data without the kind corporation of facilities, the sample in this study may not be nationally reprehensive. Even if so, we believe our finding is helpful for decreasing children's preference. In addition, this study is a cross-sectional study and can create only hypothesis. In the near future, we would test the hypotheses by interventional studies on the basis of the result of this study.

## Implications for Research

In this study, we found that children's preference was associated with their "Respect for food" and "Concern about food" using the structural equation model. We also found that a child's "Respect for food" and "Concern about food" may related to the number of foods that the child disliked and the ratio of children who disliked each of the top 10 foods. These findings may be important information for improving children's food preferences.

## Authors' Contributions

All authors participate in the conception of the research questions and writing of the manuscript. TO, ST, and NK developed the standardized protocol and the structured questionnaire. MK and TS made the arrangement for the survey at individual facilities. TO coordinated the drafting of the manuscript and carried out the descriptive and correlation analysis. All authors revised the article critically for important intellectual content and approved the final manuscript.

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