

Short Communication

Associations between Japanese schoolchildren's involvement in at-home meal preparation, their food intakes, and cooking skills

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BACKGROUND/OBJECTIVES: This study aimed to examine the association of Japanese schoolchildren's involvement in at-home meal preparation with food intake and cooking skill.

SUBJECTS/METHODS: We included 1,207 fifth-grade children aged 10-11 years and one parent of each child. A cross-sectional survey was used to collect data on involvement in at-home meal preparation. Correspondence analysis was used to classify involvement in at-home meal preparation into three groups: food-related activities (cooking only or with other activities such as shopping, table-setting, clean up, and dishwashing), non-food-related activities (table-setting and/or clean up), and no (helping) activities. Food intake was assessed using a food frequency questionnaire. Logistic regression models were used to examine involvement in at-home meal preparation associations.

RESULTS: The sample consisted of 1,207 fifth-grade children. Vegetable intake was lower in the no (helping) activities group than the food-related activities group (95% CI; boys: 1.2, 5.1, girls: 2.0, 8.9). Fewer children in the non-food-related activities group reported they were able to make a portion of their meals compared with the food-related activities group (95% CI; boys: 1.6, 3.5; girls: 1.5, 3.2).

CONCLUSIONS: Children in the food-related activities group showed more favorable food intake and cooking skills than children in the no (helping) activities or non-food-related activities group.

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INTRODUCTION

Childhood obesity is often associated with adult obesity, which can lead to a range of health problems including cardiovascular risk factors [1]. This association is partly due to eating habits formed in childhood being carried forward into adulthood [2]. Research has been carried out on factors associated with food intake in children, particularly in the home environment [3-6]. The home food environment, which includes food availability, parents' diet, and family eating patterns, plays a major role in determining children's diets [3-5]. For example, children with lower Healthy Eating Index scores, as determined by a food frequency questionnaire, were found to have access to sweetened beverages at home, and parents' intake of fruits and vegetables was shown to be positively associated with

children's total Healthy Eating Index scores [3,6]. Another study reported a positive association between children eating frequent meals with family members at home and consumption of fruits, vegetables, grains, and calcium-rich foods, along with a negative association with soft drink consumption [4]. Additionally, some studies reported associations between child involvement in at-home meal preparation and food intake and food preferences among children [7-9]. These findings suggest that nutrition education and programs encouraging children to participate in at-home meal preparation could be an effective health promotion strategy [10].

There are various types of at-home meal preparation activities, including cooking and table-setting, but the majority of studies have focused on only one type of at-home meal preparation activity, such as cooking, and its relationship to food intake

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[7,9,10]. This study examined children's involvement in a range of at-home meal preparation activities as well as the associations of these activities with food intake and cooking skills.

SUBJECTS AND METHODS

Subjects

A total of 1,447 fifth-grade students aged 10-11 years, along with their parents, were recruited for the study. The students were drawn from 19 schools in six cities in four Japanese prefectures. Of the 1,231 children who participated in the study, 1,207 showed involvement in at-home meal preparation and were included in the analysis. Fifth-grade students were recruited since school teachers and investigators concluded only upper grade students could answer the questionnaire. As sixth-grade students are close to graduation, we chose fifth-grade students as the target subjects of the study.

Study design

A cross-sectional survey was carried out between September and December 2013. The study was reviewed and approved by the Ethics Committee of the University of Niigata Prefecture (approval No.1309). The study protocol was fully explained to the children by their teachers. Pamphlets and letters were provided to the parents, and parental consent was obtained.

Measures of interest

To assess involvement in at-home meal preparation, we used the same question from the Japan Sports Council survey [11]. This question was: "Do you help in preparing meals at home?" Children were asked to choose all answers that apply. Responses included "shopping", "cooking", "table-setting", "clean up", "dishwashing", "other", and "no helping". Consumption of five food groups was assessed using a four-point scale, which was developed based on the feasibility of children to answer. These food groups were fish and meat, vegetables, fruits, eggs, and soybean products (*tofu* and *natto*). Children were asked to choose one of the following options to describe their consumption of each food group: "eat every day", "4-5 days a week", "2-3 days a week", and "rarely eat". Cooking skills were assessed using the following question: "Can you make a portion of a meal yourself?" Children answered "yes" or "no". Demographic information, such as family members living in the household with the study participant, number of siblings of the study participants, and employment status of fathers, was obtained from the parents' responses to the survey. Family structure was categorized as nuclear, single-parent, or other. Children's height and weight, measured during a health screening in September 2013 according to the School Health Law [12], were obtained from each school. Body mass index (BMI) for each participant was also calculated as weight (kg) divided by height (m²).

Statistical analysis

Correspondence analysis was used to group multiple at-home meal preparation activities as follows: 1) food-related activities (cooking only, or cooking along with other activities such as shopping, table-setting, clean up, and dishwashing), 2) non-

food-related activities (table-setting and/or clean up), and 3) no (helping) activities. Activities such as shopping only and dishwashing only were not associated with involvement in other activities by corresponding analysis and were thus excluded from the subsequent analysis. Cross-tabulations and chi-square tests were used to examine the relationship between each type of at-home meal preparation activity and food intake and cooking skills, whereas logistic regression analysis was used to determine the association of involvement in meal preparation with food intake and cooking skills.

Participants' responses regarding fruits, eggs, and soybean products were divided into two consumption categories: more than 2-3 days per week and rarely. For most children who fell into the "rarely eat" category, fish, meat, and vegetables made up less than 10% of their diet. Due to this small percentage, consumption of these foods (fish, meat, and vegetables) was divided into two categories: more than 4-5 days per week and less than 2-3 days per week. The dependent variables were food intake and cooking skills, whereas the independent variables were the types of at-home meal preparation activities. Odds ratios (OR) and 95% confidence intervals (CI) for each category of food intake were calculated after adjusting for prefecture, family structure, and number of siblings. Data were analyzed using SPSS v. 18.0. A cut-off of 0.05 was used to determine the level of statistical significance. SAS v. 9.2 (SAS Institute, Inc., Cary, NC, USA) was used for correspondence analysis.

RESULTS

Characteristics of the subjects

The study sample consisted of 584 boys and 623 girls aged 10-11 years. Proportions of the four prefectures were 22.7%, 26.6%, 33.9%, and 16.8%. The mean (SD) height, weight, and BMI of participants were 141.8 (6.9) cm, 35.9 (7.7) kg, and 17.7 (2.8) kg/m² for boys as well as 143.4 (6.9) cm, 36.0 (7.7) kg, and 17.4 (2.7) kg/m² for girls, respectively. Concerning employment status, 78.1% of fathers and 73.8% of mothers were employed, and 16.7% of fathers and 8.1% of mothers gave no answer or had no desire to answer this question. Children living in nuclear families made up 70.4% of participants, and 85.6% of children had siblings (Table 1).

Table 1. Characteristics of participants (n = 1,207)

| | n | % |
|------------------|-----|------|
| Sex | | |
| Boys | 584 | 48.4 |
| Girls | 623 | 51.6 |
| Family structure | | |
| Nuclear family | 849 | 70.4 |
| Single parent | 98 | 8.1 |
| Other | 259 | 21.5 |
| No. of siblings | | |
| 0 | 174 | 14.4 |
| 1 | 634 | 52.5 |
| ≥2 | 399 | 33.1 |

Note: There was one non-response for family structure.

Table 2. Food intake and cooking skills by involvement of fifth-grade Japanese boys and girls in at-home meal preparation

| | | Boys | | | | | | Girls | | | | | | | |
|---|-----------------|---------------------------------------|------|---|------|-------------------------|------|---------------------------------------|-----------|---|-----------|-------------------------|----------|---------|---------|
| | | Food-related activities ¹⁾ | | Non-food-related activities ²⁾ | | No (helping) activities | | Food-related activities ¹⁾ | | Non-food-related activities ²⁾ | | No (helping) activities | | P-value | |
| | | n | % | n | % | n | % | n | % | n | % | n | % | | |
| Food intake | | | | | | | | | | | | | | | |
| | | (n = 308) | | (n = 172) | | (n = 71) | | (n = 422) | | (n = 144) | | (n = 41) | | | |
| Fish and meat | Eat every day | 100 | 32.5 | 50 | 29.1 | 19 | 26.8 | 0.008 | 134 | 31.8 | 46 | 31.9 | 7 | 17.1 | 0.34 |
| | 4-5 days a week | 115 | 37.3 | 70 | 40.7 | 18 | 25.4 | | 148 | 35.1 | 57 | 39.6 | 16 | 39.0 | |
| | 2-3 days a week | 81 | 26.3 | 45 | 26.2 | 24 | 33.8 | | 120 | 28.4 | 35 | 24.3 | 14 | 34.1 | |
| | Hardly eat | 12 | 3.9 | 7 | 4.1 | 10 | 14.1 | | 20 | 4.7 | 6 | 4.2 | 4 | 9.8 | |
| | | (n = 309) | | (n = 173) | | (n = 70) | | | (n = 424) | | (n = 144) | | (n = 41) | | |
| Vegetables | Eat every day | 201 | 65.0 | 96 | 55.5 | 38 | 54.3 | NA | 278 | 65.6 | 77 | 53.5 | 15 | 36.6 | < 0.001 |
| | 4-5 days a week | 79 | 25.6 | 47 | 27.2 | 18 | 25.7 | | 100 | 23.6 | 46 | 31.9 | 13 | 31.7 | |
| | 2-3 days a week | 29 | 9.4 | 24 | 13.9 | 12 | 17.1 | | 38 | 9.0 | 18 | 12.5 | 8 | 19.5 | |
| | Hardly eat | 0 | 0.0 | 6 | 3.5 | 2 | 2.9 | | 8 | 1.9 | 3 | 2.1 | 5 | 12.2 | |
| | | (n = 309) | | (n = 172) | | (n = 71) | | | (n = 423) | | (n = 144) | | (n = 41) | | |
| Fruits | Eat every day | 55 | 17.8 | 22 | 12.8 | 7 | 9.9 | 0.05 | 66 | 15.6 | 20 | 13.9 | 9 | 22.0 | 0.03 |
| | 4-5 days a week | 88 | 28.5 | 56 | 32.6 | 23 | 32.4 | | 145 | 34.3 | 32 | 22.2 | 11 | 26.8 | |
| | 2-3 days a week | 109 | 35.3 | 59 | 34.3 | 17 | 23.9 | | 154 | 36.4 | 60 | 41.7 | 12 | 29.3 | |
| | Hardly eat | 57 | 18.4 | 35 | 20.3 | 24 | 33.8 | | 58 | 13.7 | 32 | 22.2 | 9 | 22.0 | |
| | | (n = 305) | | (n = 172) | | (n = 71) | | | (n = 423) | | (n = 143) | | (n = 41) | | |
| Eggs | Eat every day | 34 | 11.1 | 12 | 7.0 | 4 | 5.6 | < 0.001 | 39 | 9.2 | 8 | 5.6 | 6 | 14.6 | 0.40 |
| | 4-5 days a week | 95 | 31.1 | 55 | 32.0 | 19 | 26.8 | | 147 | 34.8 | 51 | 35.7 | 12 | 29.3 | |
| | 2-3 days a week | 128 | 42.0 | 87 | 50.6 | 25 | 35.2 | | 184 | 43.5 | 59 | 41.3 | 16 | 39.0 | |
| | Hardly eat | 48 | 15.7 | 18 | 10.5 | 23 | 32.4 | | 53 | 12.5 | 25 | 17.5 | 7 | 17.1 | |
| | | (n = 309) | | (n = 173) | | (n = 71) | | | (n = 423) | | (n = 144) | | (n = 40) | | |
| Soybeans products (Tofu and natto) | Eat every day | 29 | 9.4 | 10 | 5.8 | 8 | 11.3 | 0.02 | 41 | 9.7 | 11 | 7.6 | 1 | 2.5 | 0.35 |
| | 4-5 days a week | 82 | 26.5 | 44 | 25.4 | 14 | 19.7 | | 109 | 25.8 | 27 | 18.8 | 9 | 22.5 | |
| | 2-3 days a week | 138 | 44.7 | 73 | 42.2 | 22 | 31.0 | | 183 | 43.3 | 73 | 50.7 | 19 | 47.5 | |
| | Hardly eat | 60 | 19.4 | 46 | 26.6 | 27 | 38.0 | | 90 | 21.3 | 33 | 22.9 | 11 | 27.5 | |
| | | (n = 309) | | (n = 173) | | (n = 71) | | | (n = 424) | | (n = 144) | | (n = 41) | | |
| Cooking skills | | (n = 309) | | (n = 173) | | (n = 71) | | | (n = 424) | | (n = 144) | | (n = 41) | | |
| Could you make a portion of a meal yourself? | Yes | 213 | 68.9 | 83 | 48.0 | 28 | 39.4 | < 0.001 | 317 | 74.8 | 80 | 55.6 | 23 | 56.1 | < 0.001 |
| | No | 96 | 31.1 | 90 | 52.0 | 43 | 60.6 | | 107 | 25.2 | 64 | 44.4 | 18 | 43.9 | |

Note: NA = not applicable; chi-square test, *P* is considered significant at < 0.05.
¹⁾ Cooking only, or with other activities such as shopping, table-setting, clean up, and dishwashing
²⁾ Table-setting and/or clean up

Table 3. Odds ratios and 95% confidence intervals for involvement in at-home meal preparation: food intake and cooking skills

| | | Boys (n=553) | | | | Girls (n=609) | | | | | | | |
|--|-----------|---------------------------------------|--------|---|--------|-------------------------|---------|---------------------------------------|---------|---|---------|-------------------------|--------|
| | | Food-related activities ¹⁾ | | Non-food-related activities ²⁾ | | No (helping) activities | | Food-related activities ¹⁾ | | Non-food-related activities ²⁾ | | No (helping) activities | |
| | | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI |
| Food intake | | | | | | | | | | | | | |
| Fish and meat ³⁾ | | | | | | | | | | | | | |
| < 2-3 days a week | (n = 551) | 1 (ref) | 1.1 | 0.7-1.7 | 2.3 | 1.4-4.0 | 1 (ref) | 0.8 | 0.6-1.3 | 1.8 | 0.9-3.4 | | |
| Vegetables ³⁾ | | | | | | | | | | | | | |
| < 2-3 days a week | (n = 552) | 1 (ref) | 2.2 | 1.2-3.8 | 2.5 | 1.2-5.1 | 1 (ref) | 1.4 | 0.8-2.5 | 4.2 | 2.0-8.9 | | |
| Fruits ⁴⁾ | | | | | | | | | | | | | |
| Hardly eat | (n = 552) | 1 (ref) | 1.1 | 0.7-1.8 | 2.3 | 1.3-4.0 | 1 (ref) | 1.7 | 1.0-2.8 | 1.7 | 0.8-3.8 | | |
| Eggs ⁴⁾ | | | | | | | | | | | | | |
| Hardly eat | (n = 548) | 1 (ref) | 0.7 | 0.4-1.2 | 2.7 | 1.5-4.9 | 1 (ref) | 1.5 | 0.9-2.5 | 1.3 | 0.6-3.2 | | |
| Soybeans products (Tofu and natto) ⁴⁾ | | | | | | | | | | | | | |
| Hardly eat | (n = 553) | 1 (ref) | 1.6 | 1.0-2.4 | 2.6 | 1.5-4.5 | 1 (ref) | 1.2 | 0.7-1.9 | 1.4 | 0.6-2.9 | | |

Table 3. continued

| | Boys (n=553) | | | | | | Girls (n=609) | | | | |
|---|---------------------------------------|---|--------|-------------------------|--------|---------------------------------------|---|--------|-------------------------|--------|---------|
| | Food-related activities ¹⁾ | Non-food-related activities ²⁾ | | No (helping) activities | | Food-related activities ¹⁾ | Non-food-related activities ²⁾ | | No (helping) activities | | |
| | | OR | 95% CI | OR | 95% CI | | OR | 95% CI | OR | 95% CI | |
| Cooking skills | | | | | | | | | | | |
| Can you make a serving of meals yourself? ⁵⁾ | | | | | | | | | | | |
| No | (n = 553) | 1 (ref) | 2.4 | 1.6-3.5 | 3.4 | 2.0-5.8 | 1 (ref) | 2.2 | 1.5-3.2 | 2.3 | 1.2-4.4 |

Note: OR = odds ratio; 95% CI = 95% confidence interval; ref = reference; logistic regression analysis, *P* is considered significant at < 0.05.

Adjusted for prefecture, family structure, number of siblings.

¹⁾ Cooking only or with other activities such as shopping, table-setting, clean up, and dishwashing

²⁾ Table-setting and/or clean up

³⁾ > 4-5 days a week = 0, < 2-3 days a week = 1

⁴⁾ > 2-3 days a week = 0, hardly eat = 1

⁵⁾ Yes = 0, no = 1

Involvement in at-home meal preparation, food intake and cooking skills

Food intake, cooking skills, and at-home meal preparation activity groups are shown in Table 2. For boys, intakes of fish and meat, fruits, eggs, and soybean products differed significantly between the groups. For girls, consumption of vegetables and fruits differed significantly between the groups. Distribution of cooking skills showed a significant difference between the groups by gender.

Associations of at-home meal preparation activities with food intake and cooking skills are presented in Table 3. For boys, all food intake items were lower in the no (helping) activities group compared with the food-related activities group (95% CI; fish and meat: 1.4-4.0, vegetables: 1.2-5.1, fruits: 1.3-4.0, eggs: 1.5-4.9, soybeans products: 1.5-4.5). In addition, vegetable intake was lower in the non-food-related activities group compared with the food-related activities group (95% CI: 1.2-3.8). For girls, vegetable intake was lower in the no (helping) activities group (95% CI: 2.0-8.9) while fruit intake was lower in the non-food-related activities groups compared with the food-related activities group (95% CI: 1.0-2.8). The proportion of children able to make a portion of their meals was lower in the non-food-related activities groups (95% CI; boys: 1.6-3.5, girls: 1.5-3.2) and the no (helping) activities groups (95% CI; boys: 2.0-5.8, girls: 1.2-4.4) compared with the food-related activities groups.

DISCUSSION

The results of this study indicate that children who are not involved in at-home food preparation activities are less likely to consume various important food groups on a regular basis. This pattern extends to children involved in non-food-related activities.

In this study, appropriate food intake was associated with at-home meal preparation activities, especially for boys. Risk of low intake of the five food groups increased in boys in the no (helping) activities group. For girls, risk of low vegetable intake increased in the no (helping) activities group. A similar relationship between at-home meal preparation activities and food intake was reported in a recent survey [7,8]. Larson reported a relationship between food preparation frequency and higher vegetable and fruit consumption in adolescents [7]. Horst confirmed (based on an experimental setting) that involvement

of children in meal preparation can increase vegetable consumption [8].

The distinctive feature of this study was the grouping together of multiple at-home meal preparation activities to examine association of at-home meal preparation with food intake for various activity groups. Involvement in at-home meal preparation was divided into three groups: food-related activities group, non-food-related activities group, and no (helping) activities group. The results of the study show that boys in the non-food-related activities group were at increased risk of low vegetable intake while girls in the non-food-related activities group were at increased risk of low fruit intake compared with their respective food-related activities groups. These results indicate that at-home meal preparation involving food-related activities has a greater impact on children's food intake than preparation involving non-food-related activities. Previous studies [6-9] have focused on only one type of at-home meal preparation activity and its association with food intake. This study is the first to focus on between-group differences in food consumption for children engaging in non-food-related and food-related activities.

Another finding of this study is that cooking skills were associated with at-home meal preparation activities for both boys and girls. The proportion of children with no cooking skills was higher in the no (helping) activities group and non-food-related activities group compared with the food-related activities group. Hartmann reported that cooking skills are positively correlated with weekly vegetable consumption and concluded that cooking skills may facilitate achievement of daily nutritional guidelines as well as encourage children to develop their own cooking skills [13]. The second Japanese Food and Nutrition Education plan (2011) reported that increasing opportunities for children to gain cooking experience is necessary to promote preferred eating habits and to provide adequate information on nutrition [14]. Our results are consistent with these concepts and guidelines. However, in our study, only 48.0% of boys and 55.6% of girls in the non-food-related activities group reported having the ability to cook meals. Promoting involvement of these children in food-related activities will be key to improving and maintaining good eating habits in the future in order to contribute to good health.

The use of self-reported information, including at-home meal preparation activities, cooking skills, and food intake, is a

limitation of this study. Children simply answered “yes” or “no” for involvement in at-home meal preparation and cooking skills regardless of the regularity of the activity. Such short responses do not take into account inconsistencies in children’s actual meal preparation frequencies or cooking skills. In other words, children with different meal preparation frequencies and/or cooking skills could have answered the question the same way based on their interpretation of the question. In other words, children’s own interpretation of at-home meal preparation might be different. In this study, more than 70% of fathers were working, but 16.7% of fathers and 8.1% of mothers did not answer the question. Therefore, we could not examine the influence of employment status of fathers on at-home meal preparation. As we selected food groups based on feasibility of children to answer the questionnaire, further study is needed to examine the association between involvement in at-home meal preparation and other food groups. Although the response rate of study participants (85.1%) was high, generalizations based on the findings may have limitations since the study was conducted in just 19 schools in four prefectures of Japan. One of the reasons for the reduced number of participants was the requirement of parental consent, which is crucial in conducting such a survey at elementary schools in Japan.

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