The relationship between parents' dietary care and food diversity among preschool children in Japan

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Abstract

Background Increasing food diversity in early childhood diets is important; however, few studies on parental care emphasize the necessity of ensuring greater food diversity for children. The aim of this study was to identify the relationship between preschool children's dietary diversity and parents' care behaviors related to their diet including contents of foods and snacks, mealtime practice, and parent–child communication. Methods Data were extracted from the National Nutrition Survey on Preschool Children conducted among households with toddlers and preschoolers in 2015 by Japan's Ministry of Health, Labor and Welfare. Based on 2143 responses from households with children aged 2–6 years, a food diversity score (8 food groups: max of 8 points) was calculated and the distribution was confirmed. The participants were divided into higher (≥4 points, n = 1151) and lower (≤3 points; n = 992) food diversity groups. A comparison between the two groups examined parents' socioeconomic status, children's health and living conditions, and parental care concerning children's diets (13 items, including nutritional balance of foods, snack content, and regularity of mealtimes). Based on the results, a multiple regression analysis was performed relating food diversity scores to the factors of parental socioeconomic status and child health, and a logistic regression analysis was conducted to identify factors of parental care related to the higher food diversity group. Results Among the higher food diversity group, mothers were older, subjective economic status was higher, parents' skipped breakfast skipping less, and children had fewer caries and engaged in less than two hours of screen time per day. Parental care concerning children's diets was the factor most strongly associated with children's food diversity scores. Among such habits, those factors most strongly associated with higher food diversity were nutritional balance of foods (OR: 1.76; 95% CI: 1.44–2.16; p < .0001), snack contents (OR: 1.41; CI: 1.07–1.86; p = 0.014), and regular mealtimes (OR: 1.30; CI: 1.08–1.55; p = 0.005). Conclusion The findings indicate the importance of parents paying attention to the contents of children's foods and snacks, ensuring that children eat regularly, and increasing the diversity of their diets.

Background

The eating habits developed in early childhood affect long-term nutritional status and growth [1,2]. Eating a variety of foods is particularly well recognized as being important for optimal nutritional status across the life course [3]. According to the United Nations Food and Agriculture Organization (FAO), food variety refers to the consumption of a mixture of foods from a range of food groups [4]. The FAO global dietary guidelines recommend that people eat a wide variety of foods as a balanced diet, and a food diversity score (FDS) was introduced. The FDS assesses the diet of people at the local level, whereby diversity in the number of food groups can be used as an indicator to assess the nutritional quality of the whole diet and has been promoting the assessment of household and individual dietary diversity worldwide [4,5].

Recognizing the importance of developing dietary diversity during early childhood, More and Emmett proposed a dietary plan with practical food amount based on a variety of foods to ensure intake adequate nutrient intakes within preschool children's energy requirements [6,7]. However, many young children develop unbalanced diets due to picky eating, which often persist through later childhood and

into adulthood [8,9]. The National Nutrition Survey on Preschool Children conducted in Japan reported that approximately 80% of parents expressed frequent concerns about the dietary habits of their children [10]. Studies have particularly linked limited dietary variety to low intakes of fruits and vegetables and high intakes of unhealthy processed food [11,12], with possible consequences including obesity [12].

Preschool children's dietary behaviors and physical activity are associated with home environment and parental behaviors [13]. Many parents recognize the need to be aware of and closely manage their children's diet to ensure food diversity, including contents of foods and snacks (e.g., nutritional balance, flavoring and seasoning, and amount of food), mealtime practice (e.g., regular mealtimes and chewing well), and parent–child communication (e.g., cooking meals with children and eating together) [10]. In addition, parental behaviors may be efficient in improving children's diet quality [14]. Research has indicated that parents and children cooking meals together is related to higher food diversity of children's diets [15]. However, few academic studies have comprehensively examined what parental care behaviors are related to children's food diversity. Therefore, the aim of this study was to identify the relationship between preschool children's food diversity and their parents' care behaviors with regard to their diet including contents of foods and snacks, mealtime practice, and parent–child communication.

Methods

Data for this study were retrieved from the National Nutrition Survey on Preschool Children (NNSPC), which was conducted in September 2015 by the MHLW [10]. The purpose of NNSPC is to obtain basic data for promoting breastfeeding and improving the eating habits of infants and preschool children by understanding the actual conditions of nutrition and diet of infants and early childhood across the nation. This survey is conducted every 10 years.

Study population and procedure

Figure 1 shows the study population and procedure. Children aged ≤6 years as of May 31, 2015 were randomly selected from households among 1,106 districts for the Comprehensive Survey of Living Conditions, conducted by the MHLW. Three districts affected by heavy rain in September 2015 were excluded from the survey target area. First, the MHLW explained the survey method to the prefectures. Subsequently, the prefectural public health center employed investigators to visit the households selected for this survey. The investigators asked the children's mothers (or the caregiver involved in providing food to the child) to complete a questionnaire, which was collected at a later date. In total, 2,992 households with 3,936 children aged ≤6 years participated in the survey. The response rate of the survey was 56.8%. The questionnaires associated with 65 children were excluded because information on age was not available. Finally, 3,871 questionnaires were collected for analysis [10]. A database was prepared by the Maternal and Child Health Division, Department of Equal Employment and Children's Family, MHLW.

The National Nutrition Survey on Preschool Children has two types of questionnaires, one of which is restricted to infants aged <2 years and the other of which encompasses children aged 2–6 years. Data obtained from the latter questionnaire were used in this study. In total, 2143 persons responded to all items consistent with the purpose of this study.

Measurement

The survey method and items were examined by establishing an expert study group in the MHLW. At the study group, both the items to be continuously investigated and the items corresponding to the issues of age were discussed.

Children's dietary patterns in relation to the eight food groups (grains, fish, meat, eggs, soybeans/soy products, vegetables, fruit, and milk) were evaluated as objective variables, as well as their intake of processed foods, whereby four items (sweetened beverages, confectioneries, instant noodles, and fast food) were investigated. The survey inquired how often the children consumed foods in each group (≥2 times per day, once a day, 4–6 days per week, 1–3 days per week, or less than once a week or rarely) [10,16]. The FAO's food diversity score (FDS) was applied to assess the nutritional quality of the whole diet [5].

Thirteen items assessed parents' care behavior in relation to children's diets. We posed the question "Are you (parent) careful about your child's diet?" with regard to the following 13 items: 1) food : seven items comprising nutritional balance, flavoring and seasoning, size or softness, assorted arrangements and colors (color and placement of the cooked foods on the plate), amount and snack (contents, amount); 2) mealtime practice: three items comprising regular mealtimes, chewing well, table manners; and 3) parent–child communication: three items comprising enjoyment of eating, eating together, cooking together. Of the 13 items related to parental care emphasized in this study, 5 items (nutrition balance, amount, regular mealtimes, table manners, and eating together) were researched in the both 2005 and 2015 surveys, and other 8 items were newly added in the 2015 survey. Each item was scored based on "yes" or "no" responses.

Explanatory variables related to parents included their relationships with their children, age of mother, current employment status of mother, household structure (i.e., presence of other children, grandparents, and others), subjective economic status, leisure time (i.e., affluent, somewhat, neither, not so much, cannot afford at all), the place where the child spends time during the day (i.e., nursery school, kindergarten, centers for early childhood education and care, grandparents and relatives, or none of the above) and lifestyle regarding eating breakfast with parents. In addition, data concerning children's age; height; weight; nutritional status (degree of obesity); food allergies; tooth decay; and time spent on TV, video, and games were obtained.

Nutritional status of children

The nutritional status of children was determined based on body weight and height. The degree of obesity (%) was calculated using the following formula: self-reported body weight (g) − standard body weight (g) for height/standard body weight (g) for height × 100. The judgment criteria for the degree of obesity were “obese” (≥30%), “overweight” (20%–30%), “tendency to be overweight” (15%–20%), “standard” (−15% to +15%), “tendency to be underweight” (less than 15% to less than 20%), and “underweight” (less than 20%). The standard body weight was calculated using the formula of standard body weight for height in Japanese children [17,18]. The formula does not consider age because the standard body weight for height curves were almost identical for children aged 1–6 years [19].

Height and weight were self-reported questions because there is a rule that the same item should not be surveyed repeatedly to the people by different surveys according to the regulations of the MHLW. As measuring of height and weight of children is surveyed in another survey (National Growth Survey on Preschool Children), the height and weight was not measured in NNSPC and was asked in a self-reported method. However, in Japan, many parents measure the physique of an infant or preschool child at home; it is also often measured at day care centers and kindergartens. Therefore, it might be considered that several measured values were described in the survey.

Statistical analysis

The FDS of children comprised the total number of eight food groups (grains, fish, meat, eggs, soybeans/soy products, vegetables, fruits, and milk) being consumed at least once a day [4,10,19]. The FDS was one point if consumption occurred once or more per day or zero points if less than that. There were eight types of foods; thus, the maximum score was eight points. Once the FDS distribution was identified, the FDS was divided into two groups according to medians: 1) three or fewer points and 2) four or more points [4]. The processed food score was calculated according to the total number of four food items (sweetened beverages, confectioneries, instant noodles, and fast food) being consumed at least once a day [4]. As in the case of FDS, the processed food score was calculated as a score of one point if the food type was consumed at least once a day or zero points if less than that. There were four types of foods; thus, the maximum score was four points.

The sex of the parent who answered the questionnaire, age, and socioeconomic status as well as children’s sex; nutritional status; food allergies; tooth decay; and time spent on TV, video, and games were compared between the two FDS groups. Initially, parents’ socioeconomic status was compared between children’s FDS groups, and then, children’s health and lifestyle were analyzed by the two FDS groups.

Furthermore, the total value calculated from the 13 items of the parent's care behavior in children's diets was compared between the two FDS groups.

Multiple regression analysis analyzed relationships between FDS scores and several variables, including the total value of the parent's care behaviors in children's diets; subjective socioeconomic status; food allergies; tooth decay; and time spent on TV, video, and games, as well as the child's age and mother's age. The continuous variables included the total value of the parent's care behaviors in children's diets, the child's age, and the mother's age. The nominal variables such as subjective socioeconomic status; food allergies; tooth decay; and time spent on TV, video, and games were converted to an ordinal scale.

Next, we used logistic regression to specifically analyze the relationship between the variables and the higher FDS group. Multivariate analysis was performed for each of the 13 items measuring parental care in relation to children's diets using a logistic regression model that adjusted for the parent's (i.e., mother or father) relationship with the child, child's sex (i.e., male or female), employment status of the mother (i.e., yes or no), and household structure (i.e., presence of other children, grandparents, and others) (Model 1).

Additional multivariate analysis was performed for each of the 13 items measuring parental care in relation to children's diets using a logistic regression model that adjusted for the parent's (mother or father) relationship with the child, child's sex, employment status of the mother (i.e., yes or no), household structure (i.e., presence of other children, grandparents, and others), subjective economic status (i.e., affluent, somewhat, neither, not so much, or not able to afford at all), leisure time (i.e., affluent, somewhat, neither, not so much, or not able to afford at all), and place where the child spends time during the day (i.e., nursery school, kindergarten, center for early childhood education and care, with grandparents, with relatives, staying at home) (Model 2).

All statistical analyses were performed using SAS software, version 9.2 (SAS Institute, Inc., Cary, NC, USA). A probability (p) value of <0.05 was considered statistically significant.

Results

Figure 2 shows the children's FDS distribution. Scores ranged from 0 to 8 points, and there was a normal distribution with a median of 4 points. The median was divided into two groups: ≥ 4 points (n = 1151) and ≤ 3 points (n = 992).

Table 1 compares the characteristics of mother's age ($p = 0.001$) and employment status, family members living together, subjective economic status and leisure time, and the places where children spend the day according to FDS group. The "higher" FDS group was associated with higher maternal age and subjective economic status ($p < 0.0001$) than the "lower" FDS group. In addition, children of the higher FDS group were more likely to be in nursery school ($p = 0.041$), whereas children of the lower FDS group were more commonly in kindergarten ($p = 0.034$). A higher proportion of parents in the lower FDS group tended to skip breakfast ($p = 0.0002$). There were no significant differences in the other variables between the two groups.

Table 2 compares the children's age; sex; nutritional status; food allergies; tooth decay; and time spent on TV, video, or games between the two FDS groups. Overall obesity rates among the children were low. The children in the lower FDS group had more tooth decay ($p = 0.006$), whereas those in the higher FDS group had spent less than two hours per day on TV, video, or games during the weekdays ($p = 0.005$) and weekends ($p = 0.002$).

Table 3 presents differences in food intake between two FDS groups. The higher FDS group had higher frequencies of grains, fish, meat, eggs, soybeans/soy products, vegetables, fruits, and milk intake than the lower FDS group but less frequencies of instant noodle and fast-food intake.

Table 4 compares the proportion of parental care in relation to children's diets (13 items) between the two FDS groups. In the higher FDS group, the proportion of parents who were careful about the nutritional balance ($p < 0.001$), flavoring and seasoning ($p = 0.004$), assorted arrangement and colors ($p = 0.002$) , contents of snack ($p < 0.001$), amount of snack ($p = 0.015$), regular mealtimes ($p < 0.001$) , chewing well ($p = 0.002$), enjoying eating ($p = 0.032$), and eating together ($p = 0.030$) were significantly higher than in the lower FDS group.

Table 5 shows the results of the multiple regression analysis of factors related to FDS. Parental care behaviors concerning children's diets were strongly associated with children's food diversity scores. The total number of the items of parental care of children's diets ($p <0.001$) and mother's age ($p = 0.01$) were positively associated with FDS, whereas subjective economic status ($p = 0.003$) and TV, video, or games during the weekdays ($p = 0.01$) were negatively associated with FDS.

Table 6 shows the results of the associations between "parental care of children's diets" and "FDS group" using step-wise multivariate analysis.

A number of Model 1 variables were identified as predictors for FDS. Five of seven factors in the food category were positively and significantly associated with FDS: nutritional balance (odds ratio [OR] = 1.91; 95% confidence interval [CI] = 1.56–2.35; $p < 0.001$); flavoring and seasoning (OR = 1.24; 95% CI = 1.03–1.48; $p = 0.022$); assorted arrange and colors (OR = 1.35; 95% CI = 1.08–1.69; $p = 0.009$). In the snack category were positively and significantly associated with FDS; contents (OR = 1.72; 95% CI = 1.32–2.25; $p < 0.001$); and amount (OR = 1.23; 95% CI = 1.03–1.48; $p = 0.026$). Two of the three factors in the "mealtime practice" category were positively associated with FDS, namely, regular mealtimes (OR = 1.45; 95% CI = 1.21–1.73; $p <.0.001$) and chewing well (OR = 1.34; 95% CI = 1.10–1.63; $p = 0.003$). In regard to the parent–child communication, only eating together (OR = 1.23; 95% CI = 1.02–1.48; $p = 0.034$) was significantly associated with FDS.

The Model 2 analysis confirmed the variables associated with FDS. For "food," the same results as those identified for Model 1 above were achieved for nutritional balance (OR = 1.91; 95% CI = 1.56–2.35; $p <.0001$) and flavoring and seasoning (OR = 1.24; 95% CI = 1.03–1.48; $p = 0.020$).; However, slightly different yet still significant results were found related to assorted arrange and colors (OR = 1.34; 95% CI = 1.07–1.68; $p = 0.011$). Further, for "snack," were associated with FDS, contents (OR = 1.72; 95% CI =

1.31–2.24; p <0.001) and amount (OR = 1.23; 95% CI = 1.03–1.48; p = 0.027). Similarly, for the “mealtime practice” category, the same results were identified for chewing well (OR = 1.34; 95% CI = 1.10–1.63; p = 0.004); however, slightly different values were found regarding the association between FDS and regular mealtimes (OR = 1.44; 95% CI = 1.21–1.72; p <.0.001). In the parent–child communication category, eating together (OR = 1.22; 95% CI = 1.01–1.48; p = 0.037) was again the only factor significantly associated with FDS.

The results of the stepwise analysis identified several predictors for FDS, including nutritional balance of food (OR = 1.76; 95% CI = 1.44–2.16; $p < 0.001$), snack contents (OR = 1.41; 95% CI = 1.07–1.86; $p = 0.0014$), and regular mealtimes (OR = 1.30; 95% CI = 1.08–1.55; $p = 0.005$).

Discussion

This study identified a relationship between preschoolers’ dietary diversity and parental care of the contents of children’s foods and snacks, as well as regular mealtimes. In other words, FDS could be used to assess children’s diet quality.

Greater food diversity was associated with higher mother’s age and subjective economic status. Lower food diversity was associated with a higher likelihood that parents skipped breakfast and greater consumption of processed or fast foods, as well as more time spent per day on TV, video, or games. Furthermore, in the higher FDS group was significantly associated with greater parental care about the contents of children’s diets and qualitative aspects of eating, such as regular mealtimes and eating together.

In Japan, where the social trend of people owning and spending time on smart phones or tablet PC has been increasing, it was reported that a mother’s unhealthy lifestyle correlates strongly with prolonged screen time among school-aged children [20]. A European longitudinal study targeted 2–9 year old children and indicated the effects of TV viewing and other screen activities for young children, both on their consumption of sugary drinks and an increase in BMI [21]. In Japan as well, it would be necessary to study the effect of screen time during early childhood on the children’s food and snack intake.

In Japan’s NNSPC, the proportion of parental participants who ensured the nutritional balance of foods (72.0%) was higher than those who were careful about snack contents (12.4%) and having regular mealtimes (45.0%). The results indicate that parents who reported diverse diets are more likely to ensure regular mealtimes. The effects of meal timing and frequency on children’s health has been a research topic for many years, and preparing foods and snacks and having children eat them at regular times has been identified as an important daily habit. Considering how to change the behavior of parents and children who do not have regular mealtimes is a complex issue. Previous study findings have indicated a close relationship between children’s mealtimes and their parents’ working times and other lifestyle elements [22]; in this context, behavior change can be difficult. Moreover, many young children also receive foods at places outside the home, such as at nursery schools and kindergartens. In this context, our findings of less dietary diversity among kindergartners are notable.

Much of the literature emphasizes the importance for young children to eat a variety of foods to ensure appropriate nutrient intake [6]. Metcalfe et al. found that family food involvement at age three is predictive of healthier dietary intake at age four (increased consumption of fruits and vegetables, decreased consumption of fast food) [23]. It may be possible to change parents' behavior and increase dietary diversity by providing nutritional guidance on the contents of foods and snacks consumed both in and outside out of the home [24]. In addition, to combat picky eating habits, it is important to promote interventions that support skills for food choice and preparation [25] and food environments that change the diet quality at home [26,27]. Ishikawa et al. identified a significant relationship between parents and children cooking together and dietary diversity [15]; however, this finding rather emphasizes the importance of eating meals together, and parent–child cooking activities were not directly associated with diversity in children's diets. According to Helland et al, behaviors that can improve food diversity in early childhood include to modeling, responsive feeding, repeated exposure, and enjoyable meals [11].

A study conducted by Fernandez et al. indicated that higher food diversity may be positively associated with increasing BMI of children [12]; however, in our study, no significant association was found between food diversity and this element of child nutritional status. This may be due to lower overall obesity rates among the study's participants.

According to the results of this study, to broaden the food diversity of children, it is important to consider the content of snacks as well as foods. Prior research has identified fruits, milk, and dairy products among the top 10 most frequently eaten foods and beverages consumed as snacks by children in Australia, China, Mexico, and the US; however, confectionery, cookies, candy, ice creams, and cakes are also seen among the top 10 snacks. These undermine the nutritional benefits of healthier foods and contribute to poor dental health [28].

According to the results of the NNSPC, 41.9% of 2- to 3-year-old and 28.9% of 5-year and older children consume sweetened beverages and confectionaries twice a day or more as snacks. The proportion of those who did not have a fixed snack time was 43.7% [10]. It is important to include snack contents and timing in early childhood nutritional education. However, few reports have focused on the effects of snack contents, amount, and timing on the health of preschool children in Japan, although some dental investigations of preschool children suggest a significant relationship between snack items (e.g., sweet buns) and caries [29,30,31].

Despite a broad agreement that snacks contribute significant energy to children's diets, evidence of the effects of snacks on health status, especially in children, is still weak. The lack of consistent evidence related to this issue may be partly due to a non-standardized definition of snack contents [32]. In the future, it will be necessary to research the actual situation of snack contents and amount to decide on snacks for young children.

The systematic review study presents negative food parenting practices, such as setting restrictions and pressurizing to eat, compared with the positive practices such as being a role model, setting healthy limits, or providing encouragement. Therefore, it would be beneficial for future studies to include positive

parenting behaviors for identifying how these can be supported and translated into public health interventions [33]. The active guidance/education will be important to make the parental behaviors on child's food consumption desirable [34].

There were several limitations to this study that should be addressed. First, the response rate of the survey was only 56.8%. We relied on the 2015 database of the National Nutrition Survey on Preschool Children conducted by the MHLW. In that investigation, 3,871 questionnaires were collected from 3,936 children; however, only 2,143 participants responded to all of the survey items. The most unanswered items concerned height, weight, and subjective economic status. It might have been difficult for some parents to subjectively gauge their economic status. However, the height and weight might be measurable at homes, daycare centers, or kindergartens. As this survey is conducted every 10 years by the MHLW, it is necessary to devise a method to increase the response rate for such items in future surveys.

Items related to the dietary habits of parents were limited. In many cases, parental behaviors related to their children's diets may be influenced by limitations in their own dietary habits.

In addition, it is unknown how the participants' care of children's diets may have impacted children's physical and mental development. A number of studies have examined associations between mealtimes and the physical and mental health of children [22,31,35], and a few researchers have reported a relationship between mealtimes and food diversity [13,23]. Therefore, further research on this issue is required.

Lastly, information regarding food and snack contents and behaviors was self-reported, as was information concerning TV habits and socioeconomic status. In the future, it will be necessary to research the actual situation of lifestyles and parents' food and snack behaviors rather than rely on self-reported information.

Conclusion

This study assessed relationships between young children's dietary diversity and parental care behaviors regarding foods and found that parental care was a predictor of greater food diversity. The food diversity of children's diets is strongly based on parents' care concerning the contents of children's foods and snacks and regular mealtimes. The results of this study can be used to inform efforts to develop and implement nutritional guidance education for parents and nutrition staff, including school meal providers.

Abbreviations

MHLW: Ministry of Health, Labour and Welfare; MCH: maternal and child health; SD: Standard deviation; OR: Odds ratio; CI: Confidence interval; Lsmeans: Least squares mean; SE: Standard Error

Declarations

Ethics approval and consent to participate

The study protocol was approved by the Ethics Committee of the National Institute of Public Health, Wako, Saitama, Japan (NIPH-TRN#12021, February 1, 2018).

Consent for publication

Not applicable.

Availability of data and materials

Permission for the use of the dataset in the current study was obtained from the MHLW, Japan. All data belong to the MHLW, and the database cannot be used for other studies.

Competing Interests

The authors declare that they have no competing interests.

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Authors’ contributions

MI designed the research and wrote the manuscript and TY provided statistical analysis support. KE, MH, TY, NY contributed to interpreting the data and revising the manuscript for scientific clarity. All authors read and approved the final manuscript.

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Tables

Due to technical limitations, tables are only available as a download in the supplemental files section.

Figures

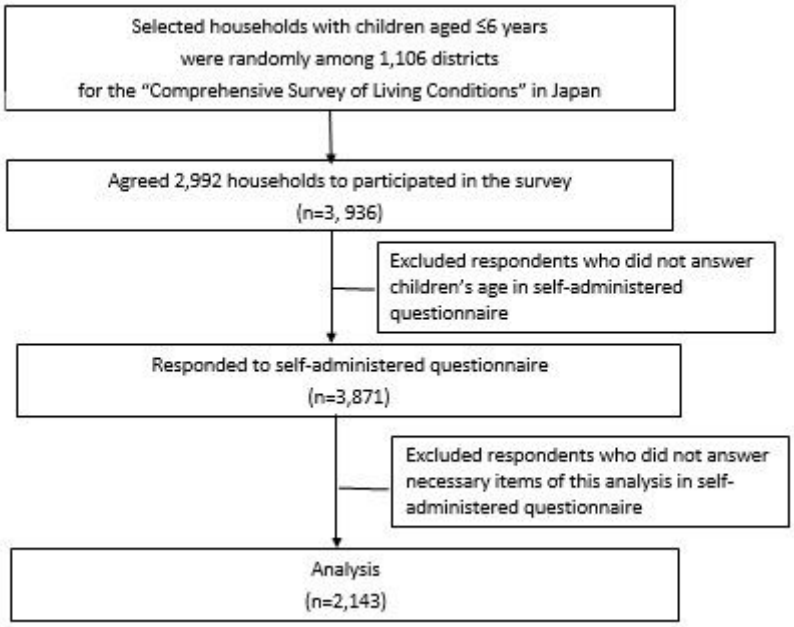

Figure 1

Study population and procedure diagram of this study

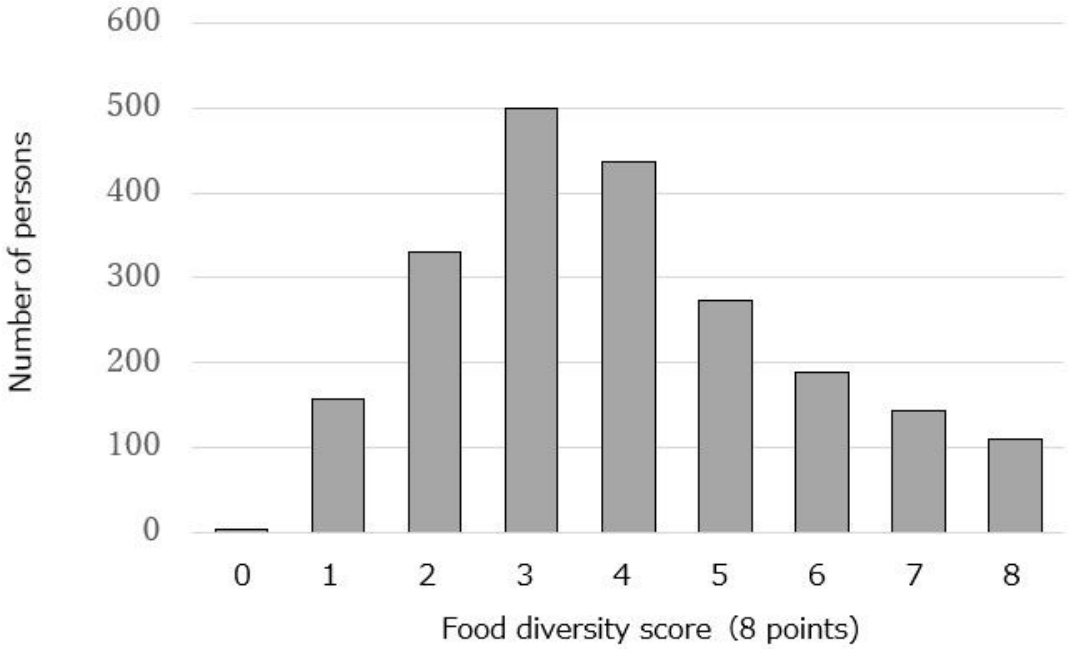

Figure 2

Supplementary Files

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