The association between family economic status and nutrient intake among preschool children attending nursery schools in Japan

doi: 10.6133/apjcn.202602/PP.0003
Published online: February 2026

Running title: Income and dietary intake of Japanese children

Atsuki Sakai RD, MSc[1], Katsushi Yoshita RD, PhD[1], Takako Takahashi RD, PhD[1], Tetsuko Okabe RD, PhD[2], Ruriko Sasaki RD, MSc[3], Hiromi Ishida RD, PhD[4], Hiromitsu Ogata PhD[4], Aya Abe PhD[5], Mitsuhiko Hara MD, PhD[6], Yukiko Yoshioka RD, PhD[7], Miho Nozue RD, PhD[8], Tatsuaki Sakamoto RD, PhD[9], Sanae Ito RD, MSc, PhD[10], Nobuko Murayama MSc, PhD[11]

[1]Department of Nutrition, Graduate School of Human Life and Ecology, Osaka Metropolitan University, Osaka, Japan
[2]Department of Nutrition, School of Nursing and Nutrition, Tenshi College, Hokkaido, Japan
[3]Department of Nutrition, Faculty of Human Life Science, Miyagi Gakuin Women's University, Department of Food and Nutritional Science, Miyagi, Japan
[4] Department of Applied Nutrition, Faculty of Nutrition, Kagawa Nutrition University, Saitama, Japan
[5]Department of Human and Social Sciences, School of Humanities and Social Sciences, Tokyo Metropolitan University, Tokyo, Japan
[6]Department of Health and Nutrition, Faculty of Human Ecology, Wayo Women's University, Chiba, Japan
[7]Department of Nutritional Management, Faculty of Nutritional Science, Sagami Women's University, Kanagawa, Japan
[8]Department of Health and Nutritional Sciences, Faculty of Health Promotional Sciences, Tokoha University, Shizuoka, Japan
[9]Department of Food &Health Sciences, Faculty of Environmental and Symbiotic Sciences, Prefectural University of Kumamoto, Kumamoto, Japan
[10]Department of Health Sciences, Faculty of Medicine, University of the Ryukyus, Okinawa, Japan
[11]Department of Health and Nutrition, Faculty of Human Life Studies, University of Niigata Prefecture, Niigata, Japan

Authors' email addresses and contributions:
AS: sy23218p@st.omu.ac.jp
Contribution: analyzed and wrote the article.

KY: h21157y@omu.ac.jp
Contribution: formulated the research question, designed the study, conducted the study, analyzed and wrote the article.

TT: o21735h@omu.ac.jp
Contribution: formulated the research question, designed the study and conducted the study.

TO: okabe@tenshi.ac.jp

Contribution: formulated the research question, designed the study and conducted the study.

RS: r-sasaki@mgu.ac.jp
Contribution: formulated the research question, designed the study and conducted the study.

HI: ishida@eiyo.ac.jp
Contribution: formulated the research question, designed the study and conducted the study.

HO: ogata.hiromitsu@eiyo.ac.jp
Contribution: formulated the research question, designed the study and analyzed.

AA: ayaabe@tmu.ac.jp
Contribution: formulated the research question and designed the study.

MH: m-hara@wayo.ac.jp
Contribution: formulated the research question and designed the study.

YY: yoshioka_yukiko@isc.sagami-wu.ac.jp
Contribution: formulated the research question, designed the study and conducted the study.

MN: nozuemiho@gmail.com
Contribution: formulated the research question, designed the study and conducted the study.

TS: sakamoto3@pu-kumamoto.ac.jp
Contribution: formulated the research question, designed the study and conducted the study.

SI: sanaei@cs.u-ryukyu.ac.jp
Contribution: formulated the research question, designed the study and conducted the study.

NM: murayama@unii.ac.jp
Contribution: formulated the research question, designed the study, conducted the study, and supervision

Corresponding Author: Mr. Atsuki Sakai, Graduate School of Human Life and Ecology, Osaka Metropolitan University, 2-1, Morinomiya, Joto-ku, Osaka-shi, Osaka, 536-0025, Japan. Tel: +81-80-4970-7282. Email: sy23218p@st.omu.ac.jp

ABSTRACT

Background and Objectives: This cross-sectional study investigated the association between equivalent income and energy and nutrient intake among nursery school children. **Methods and Study Design:** A total of 761 preschool children aged 3 to 6 years participated. Energy and nutrient intakes were calculated using four-day food records consisting of two non-consecutive weekdays and two non-consecutive weekend days, collected between October and December in 2019 and 2020. Equivalent income was calculated by dividing household income by the square root of the number of household members. Nutrient inadequacy was evaluated using the DRIs for Japanese (2020). Analysis of covariance was used to compare intakes among equivalent income groups, and $\chi 2$ tests were used to compare the prevalence of nutrient inadequacy. Analyses were conducted separately by sex, with significance set at $p < 0.05$. **Results:** Children in the low equivalent income group had a lower percentage of energy from protein, a higher percentage from carbohydrates, and lower intakes of several nutrients. Evaluations based on the DRIs showed higher prevalence of nutrient inadequacy including vitamin A, calcium and iron in the low equivalent income group. **Conclusions:** These findings suggest a significant association between household economic status and dietary intake among preschool children in Japanese nursery schools. Collaboration among families, dietitians and local governments is essential to promote healthy eating habits in early childhood.

Key Words: nursery school, preschool children, nutrient intakes, equivalent income, DRIs for Japanese

INTRODUCTION

Research examining the association between socioeconomic status (SES) and health outcomes has expanded in recent years. Low SES is associated with increased mortality and morbidity,[1,2] and health disparities due to SES differences are prevalent among adults and children.[3] Therefore, developing effective interventions is essential for addressing SES-related disparities across all age groups. In Japan, the child poverty rate has been gradually increasing since 1985, reaching 13.5% in 2018.[4,5] Reducing child poverty has become a key issue, promoting new initiatives such as the establishment of the Child and Family Agency and the enforcement of the Basic Act for Children in 2023.

The National Health Promotion Movement lists the reduction of health disparities as major goal.[6] It is well established that SES influences dietary intake, which contributes to health disparities. In Japan, several studies have examined the association between SES and dietary intake among adults and school-aged children.[7-9] Nishi et al. reported that low-income adults consume less total energy, fewer vegetables and fruits, and more grains.[7] Additionally, SES has been found to be associated with intake of carbohydrates and fats.[8] Murayama et al. reported that school children from lower income groups had less frequent vegetable intake, lower intake of protein, vitamins and minerals and a higher percentage of energy from carbohydrates.[9] Similar associations have been reported in other Asian countries, including Korea and China.[10-12] While the association between SES and diet has been well studied in adults and school-aged children, research focusing on preschool children remains limited. Eating habits formed in early childhood influence those during school age and adulthood, and desirable eating habits may reduce the risk of future noncommunicable diseases.[13,14] Thus, it is important to address SES-related disparities from early childhood and to promote healthy eating habits to maintain long-term health.

As of September 2023, there were 39,589 nursery schools in Japan, with 52.4% of all preschool children attending these facilities.[15] Nursery schools primarily serve children aged 0 to 6 years who require care due to parental employment or other reasons. These facilities typically operate five weekdays per week and provide meals, including lunch and an afternoon snack. Children are grouped by age and remain in these groups throughout the day. Nursery schools are broadly classified into two types, public and private. Public nursery schools are operated by local government, while private ones are operated by private entities. However, both types are required to comply with the Standards for Equipment and Operation of Child Welfare Facilities stipulated and employ certified childcare professionals.[16] Given that a large proportion of preschool children in Japan attend nursery schools, investigating dietary intake among children attending nursery schools is critically important for dietitians and public health professionals.

This study investigated the association between SES, measured by equivalent income (EI), and energy and nutrient intakes among children attending Japanese nursery schools.

MATERIALS AND METHODS

Study participants

This cross-sectional study was conducted in seven regions of Japan, with one government-designated or core city was selected per region. Nursery schools were selected in consultation with local government. Participants were preschool children aged 3 to 6 years and their parents from 40 nursery schools (21 private and 19 public).

Data collection was conducted in two regions in 2019 and five in 2020, with different regions surveyed each year. Participants were recruited through participating institutions. Parents completed food record and a self-administered questionnaire about their children's dietary habits. A self-administered questionnaire included items on SES such as parental education, income, household size, child characteristics, and lifestyle factors including child's food allergies. After an explanatory session on the study procedures, participation requests were distributed to 2,703 parents. A total of 850 provided written informed consent, resulting in a participation rate of 31.4%. We excluded 49 participants who did not complete the four-day food record, 3 with missing physical measurement data, and 37 with incomplete SES information. Ultimately, 761 children (423 boys and 338 girls) were included in the analysis yielding a valid response rate of 28.2%.

This study was conducted in accordance with the Declaration of Helsinki and approved by the ethics committee of the University of Niigata Prefecture, Japan (Approval No. 1918) and the ethics committee of the Osaka City University, Japan (Approval No. 19-32).

Food record

Dietary intake was recorded over four days using food record method, consisting of two non-consecutive weekdays and two non-consecutive weekend days from October to December.

Meals at nursery schools

Most nursery schools in Japan prepare meals on-site, planned by dietitians in accordance with the DRIs and the Guidelines for Food Service in Childcare Centers.[17,18] Portion sizes are precisely determined based on these guidelines to ensure nutritional adequacy.

For meals served at nursery schools, nursery staff recorded children's food consumption using standardized recording forms, estimating the portion sizes consumed for each food category including grain dishes, vegetable dishes, fish and meat dishes, soup.[19] All staff received standardized manual to ensure consistency in recording method across facilities.

Meals consumed at home

Parents weighed and recorded all food consumed at home using provided forms. Each was given four daily forms, along with instruction sheet illustrating the recording method, a digital scale (Tanita, Tokyo: digital scale KJ-114 or other equivalent), a measuring cup (Kagawa Nutrition University, Tokyo: measuring cup 200 mL), and a measuring spoon/spatula (Kagawa Nutrition University, Tokyo: 15 ml/5 mL). Dietitians reviewed the records and contacted parents to see if clarification or corrections were needed.

Calculating energy and nutrient intakes

Daily energy and nutrient intakes were calculated using the "*Shokuji Shirabe*" a nutrition calculation software, based on the Japanese Standard Tables of Food Composition 2015 (7th revision).[20] Intakes were averaged over the four days. In this study, weekdays were defined as days children attended nursery schools and consumed lunch there, while weekends referred to non-attendance days.

A self-administered questionnaire collected information on children's food allergy status, family structure, parental education level, and annual household income.

Body composition and anthropometry

Each facility provided the most recent height and weight measurements typically obtained within one month before the first day of food recording. Measuring instruments were not standardized across facilities. The degree of obesity was calculated based on height and weight using a formula based derived from the National growth survey on preschool children in Japan and classified into three categories:[21] less than -15%, between -15% and 15%, and 15% or more.[22]

Degree of obesity (%) = [Body weight (kg) - Standard body weight for height * (kg)] / [Standard body weight for height * (kg)] × 100.

Boys: standard body weight = $0.00206 \times \text{height (cm)}^2 - 0.1166 \times \text{height (cm)} + 6.5237$

Girls: standard body weight = $0.00249 \times \text{height (cm)}^2 - 0.1858 \times \text{height (cm)} + 9.0360$

Calculation of EI

Participants were asked the following question regarding annual household income: "Approximately what was your family's total annual income (including income from employment, self-employment, business, agriculture, real estate, interest, dividends, bonuses, and pensions, before tax) for the past year? Please include the combined income of all household members who share a household budget." Participants selected from nine categories (e.g., <1 million yen, 1 to 2 million yen, …≧8 million yen; 1 million yen (equivalent to $ 6,820 in 2023)). Each income categories were converted to a representative value using the midpoint of the range. EI was calculated by dividing the household income by the square root of the number of household members. EI was selected as an indicator of household economic status because it adjusted for household size, reflecting the actual economic resources available per household member.[23]

Assessment of nutrient intake inadequacy

Usual nutrient intakes were estimated based on the four-day using the "Program for Estimating the Distribution of Usual Nutrient Intake Based on Dietary Survey Data, Version 1.2.".[24] A Box-Cox transformation was applied. The DRIs, 2020 were used as reference.[17] Nutrient inadequacy was assessed for nutrients with established Estimated Average Requirements (EAR) and tentative Dietary Goal for preventing lifestyle related diseases (DG). Among the nutrients with an EAR, iodine, selenium, and molybdenum were excluded from the analysis.[25] The EAR represents the daily intake level estimated to meet the requirements of 50% of individuals in the population. A high proportion of individuals with intakes below the EAR indicates a potential public health concern.[17] For each group, the proportion of individuals with intakes below the EAR was calculated. The DG, which serve as target intake levels for the prevention of lifestyle-related diseases, were used as reference indicators for relevant nutrients. For protein, fat, and carbohydrates, the DG is expressed as a recommended range. The proportions of individuals with intakes below the lower limit or above the upper limit of the range were calculated. For SFA, B-6 and sodium (expressed as salt equivalent), the proportion of individuals exceeding the DG was calculated. For dietary fiber and potassium, the proportion of individuals with intakes below the DG was calculated.

Statistical analysis

Participants were divided into tertiles by EI. The Kruskal–Wallis test was used to compare EI, age, height, weight, and degree of obesity across groups. χ^2 tests were performed to examine group differences in regions, household composition, educational background of father and mother, presence of food allergies, and obesity classification.

Analysis of covariance was conducted to compare energy and nutrient intakes among groups, with regions, educational background of father and mother, and presence of food allergies included as fixed factors, and age and degree of obesity included as covariates. The survey year was not included as a covariate because different regions were surveyed in each year, potentially confounding regional effects. Bonferroni correction was applied for multiple comparisons. In addition, multiple linear regression analysis adjusted for the same covariates was performed to assess trends in energy and nutrient intake across the three EI groups. All statistical analyses were conducted using IBM SPSS Statistics version 30.0 (IBM Japan, Tokyo). A two-sided significance level of 5% was applied. All analyses were conducted separately by sex.

RESULTS

Study population

Continuous variables are presented as medians with 25th and 75th percentiles, and categorical variables are presented as numbers and percentages (n (%)). No significant differences in age, height, weight, or degree of obesity were observed among the three groups for either boys or girls. χ^2 tests revealed significant differences in regions, household composition, and educational background of father and mother for both sexes. The proportion of single-parent households and of parents without a university or graduate school education was significantly higher in the low EI group. No significant differences were found among the groups for obesity classification or the presence of allergies.

Association between EI and intake of usual nutrient

Tables 2 and 3 show the comparisons of energy and nutrient intakes among the three groups. For boys, the adjusted mean energy intake was 1,440 kcal (6,040 kJ), 1,430 kcal (5,980 kJ), and 1,440 kcal (6,030 kJ) from the lowest to highest income group, respectively ($p = 0.883$). For girls, the adjusted mean energy intake was 1,350 kcal (5,640 kJ), 1,320 kcal (5,510 kJ), and 1,340 kcal (5,600 kJ) ($p = 0.498$). No significant differences in energy intake were observed among the groups for either sex. Among boys, significant differences were observed in the percentage of energy from protein and intake of calcium and iron, with all being lower in the low EI group. Multiple linear regression analysis showed that boys in the low EI group tended to have significantly lower percentage of energy from protein and fat, and lower intakes of protein, vitamin D, niacin, vitamin B-12, folate, potassium, calcium, magnesium, iron, phosphorus, and zinc, while the percentage of energy from carbohydrates tended to be significantly higher (Table 2).

Among girls, the percentage of energy from fat, percentage of energy from SFA, and the intake of vitamin B-12 and calcium were significantly lower in the low EI group, while the percentage of energy from carbohydrates was significantly higher. Multiple linear regression analysis showed a significant decreasing trend in the percentage of energy from SFA, as well as intake of vitamin B-12, and calcium in the low EI group (Table 3).

Assessment of nutrient intake inadequacy using the DRIs

The proportion of individuals with inadequate nutrient intake was compared among the three groups based on the DRIs. Among boys, the proportion of children not meeting the DG for protein and potassium, as well as those with intakes below the EAR for vitamin A, calcium, and iron, was significantly higher in the low EI group. Conversely, the proportion of children not meeting the DG for carbohydrates was significantly lower in the low EI group (Table 4). Among girls, the proportion of children not meeting the DG for fat and SFA was significantly lower in the low EI group. The proportion of children with intakes below the EAR for calcium was significantly higher in the low EI group (Table 5). For macronutrients with DG, the proportion of children exceeding the upper DG limit was 0% for protein in both boys and girls, 99% for lipids in boys and 100% in girls, and 0.1% for carbohydrates in boys and 44% in girls.

DISCUSSION

This study suggests that among Japanese preschool children, EI is associated with nutrient intake, with lower EI linked to a higher likelihood of nutrient inadequacy.

Consistent with previous studies of adults and children,[7-9] lower EI was associated with lower intakes of several nutrients, including vitamin A and calcium. Although previous studies have reported lower energy intake among adults from low-income households,[7] this association was not observed in this study. Average energy intake was like the values reported in the 2019 National Health and Nutrition Survey for children.[26] Previous studies have reported that children from lower-income households tend to have a higher percentage energy from carbohydrates,[9] and similar results were shown in this study. Furthermore, the low EI group showed lower percentages of energy from fat and protein, and higher percentages from carbohydrates. The associations between EI and intake of certain vitamins and minerals were more pronounced among boys. This may indicate that girls are more likely than boys to consume healthier foods consistent with previous research.[27-29]

Our previous research examining equivalent income and food group intake showed that lower income was associated with lower consumption of vegetables, dairy products, and other nutrient dense food groups.[30] In general, vegetables, fruits and dairy products tend to be relatively expensive and provide less energy per unit compared with staple foods such as cereals. Under economic constraints, these food groups may therefore be deprioritized in household food choices as families prioritize meeting basic energy needs.[7, 31] Consistent with the hypothesis that economic constraints shape food selection patterns, children from lower-income households in the present study had a higher percentage of energy from carbohydrates. This pattern likely reflects a greater reliance on energy-dense foods such as cereals and cereal-based products. These findings highlight how, under economic constraints, maintaining adequate energy intake comes at the cost of lower overall dietary quality.

Improving access to nutrient-dense foods such as vegetables, fruits, and dairy products through supportive food environments and policy measures may be necessary to reduce socioeconomic disparities in diet quality among preschool children.

Although various forms of support can be considered, challenges related to diet in early childhood are highly heterogeneous, depending on household circumstances and facility conditions, and cannot always be adequately addressed through uniform interventions. To effectively respond to such diversity, expanding the placement of qualified professionals, such as registered dietitians, in childcare facilities may represent a potentially feasible and context sensitive approach under limited public health resources. These professionals can assess facility- and child-level dietary conditions from a specialized perspective and provide tailored support according to contextual needs. Local governments are expected to establish institutional frameworks that facilitate the implementation of such professional support. At the same time, although the present observational study design did not permit direct cost-effectiveness analysis, comparing the cost-effectiveness of different policy options such as subsidies for nursery school meals, household food assistance, and community-based nutrition education remains an important issue for future research.

Consistent with the DRIs assessment, children from lower EI were more likely to fall below nutrient requirements. Among girls, a higher proportion in the high EI group exceeded the DG for fat and SFA. This may indicate a risk of overconsumption. Thus, both undernutrition and overnutrition in this population must be addressed. Early childhood is critical for forming lifelong dietary habits, making regular monitoring and targeted nutritional support essential. Dietitians in nursery schools should provide appropriate guidance on achieving a well-balanced diet tailored to household financial conditions.

Many Japanese child welfare facilities provide lunch and snacks planned by dietitians, which suggests that children attending these facilities receive certain baseline level of nutrient support. Previous studies have reported that school lunches can reduce socioeconomic disparities in children's diet,[32] and nursery school meals may similarly contribute to mitigate such disparities in preschool children.

However, the extent to which nursery school meal provision attenuates socioeconomic disparities in nutrient intake could not be quantified in the present study, because all participating nursery schools provided meals and no comparison data were available from facilities without meal provision. Nevertheless, the relatively modest differences observed for several nutrients across EI groups suggest that meals provided in nursery schools may contribute, to some extent, to the attenuation of socioeconomic differences in nutrient intake.

However, as a substantial proportion of children's dietary intake occurs outside nursery school, the influence of household dietary practices is likely to remain considerable, underscoring the importance of improving the home food environment. To more precisely evaluate this potential role of nursery school meals in attenuating socioeconomic disparities in nutrient intake, future studies should compare children attending nursery schools with those in settings where organized meals are not provided, such as home-based care, and, where possible, incorporate information on meal content and nutritional standards.

Calcium intake was inadequate across all EI groups and sexes, with over 50% of children below the EAR. This widespread inadequacy suggests a need to improve calcium intake, particularly via snacks. Murakami et al. pointed out that nutrients like calcium and iron are hard to meet through meals alone.[33] Snack menus in nursery schools should address these gaps, and families should receive appropriate guidance on healthy snacking.[25]

In 2022, 64.8% of child welfare facilities in Japan employed dietitians.[34] Nozue et al. reported better nutritional management in facilities with dieticians than those without.[35] Increasing the number of dietitians in nursery schools may enhance nutrition support and provide appropriate information to parents, ultimately fostering healthier eating habits among preschool children. Practical nutrition guidance such as affordable, balanced recipes and awareness of the importance of nutrient adequacy should be provided to families in economic hardship. Lower intake of vegetables and fruits among low-income households has been reported,[36] underscoring the need for policies that improve access and affordability. Creating supportive food environments requires cooperation from nursery schools, municipalities and dietitians. This study has several strengths. First, the study regions were selected from across Japan, likely minimizing regional bias. Second, food records were conducted over four days, whereas many previous studies collected only three days. This extended observation period offers a more accurate picture of usual intake.

Limitations should be noted. First, the findings may not be generalizable to children in home daycare or not attending nursery schools. Second, the response rate was relatively low at 28.2%, introducing potential bias due to non-participation. Families with higher socioeconomic status and greater health awareness may have been more likely to participate in the survey. As a result, dietary quality and nutrient intake may be overestimated, and socioeconomic disparities in dietary intake among nursery school children may be underestimated. Therefore, the observed associations between socioeconomic factors and children's nutrition should be interpreted as potentially conservative. Children from disadvantaged households may be less likely to attend nursery schools and receive nutritional support,[37] warranting further study. Third, food record method is burdensome and self-reported, risking underreporting and underestimation of nutrient intake. Consequently, the prevalence of inadequacy based on the DRIs may be overestimated. Additionally, participants may have been more health conscious than the general population, introducing selection bias. Finally, this study was conducted in 2019 and 2020 during which COVID-19 affected household finances. Sakamoto et al. reported increased consumption of sweets and sugary beverages among preschool children from low-income households during this period.[38] Although there were no significant differences in energy intake between 2019 and 2020 in our study population, differences in surveyed regions between the two years prevented clear assessment of pandemic-related impacts. Thus, the 2019 and 2020 data were combined for analysis. As the pandemic may have disproportionately affected low-income households, dietary quality among children from disadvantaged households may have been more adversely impacted than observed in the present analysis. Consequently, socioeconomic disparities in dietary patterns may have been underestimated, and the observed associations should be interpreted with caution.

Conclusion

Among preschool children aged 3 to 6 years attending nursery schools, this study suggested an association between EI and several key nutrient intakes. Nutrient inadequacy was more common in the low EI group, suggesting that they may be at higher nutritional risk. Public health policies to address dietary disparities by SES from early childhood are essential. Efforts should include providing practical nutritional support for economically vulnerable families and improving food environments. To promote healthy dietary habits among preschool children, collaboration among families, dietitians, and local government is necessary to ensure positive, sustainable impacts on childhood nutrition.

ACKNOWLEDGEMENTS

The authors thank all participants, their families and facility personnel for their cooperation in this study.

CONFLICT OF INTEREST AND FUNDING DISCLOSURE

The authors declare no conflict of interest.

This research was supported by the Ministry of Health Labour and Welfare, Japan [grant numbers 19DA200].

REFERENCES

1. Kagamimori S, Gaina A, Nasermoaddeli A. Socio economic status and health in the Japanese population. Soc Sci Med. 2009;68:2152-60. doi: 10.1016/j.socscimed.2009.03.030.
2. Marmot M. Social determinants of health inequalities. Lancet. 2005;365:1099-104. doi: 10.1016/S0140-6736(05)71146-6.
3. Okamoto S. Parental socioeconomic status and adolescent health in Japan. Sci Rep. 2021;11:12089. doi: 10.1038/s41598-021-91715-0.
4. Summary report of Comprehensive Survey of Living Conditions 2019. Ministry of Health, Labour and Welfare of Japan; 2019 (in Japanese). [cited 2026/1/24]; Available from: https://www.mhlw.go.jp/english/database/db-hss/dl/report_gaikyo_2019.pdf.
5. Ogata Y, Yokoyama Y, Akiyama Y, Yamagata Z. Relationship between economic disparity and eating habits of 3-year-old children. Nihon Kosyu eisei zasshi. 2021;68:493-502. doi: 10.11236/jph.20-114.
6. A Basic Direction for Comprehensive Implementation of National Health Promotion. Ministry of Health, Labour and Welfare of Japan; 2012. [cited 2026/1/24]; Available from: https://www.mhlw.go.jp/file/06-Seisakujouhou-10900000-Kenkoukyoku/0000047330.pdf. (in Japanese)
7. Nishi N, Horikawa C, Murayama N. Characteristics of food group intake by household income in the National Health and Nutrition Survey, Japan. Asia Pac J Clin Nutr. 2017;26:156-9. doi: 10.6133/apjcn.102015.15.
8. Sakurai M, Nakagawa H, Kadota A, et al. Macronutrient intake and socioeconomic status: NIPPON DATA2010. J Epidemiol. 2018;28:S17-22. doi: 10.2188/jea.JE20170250.
9. Murayama N, Ishida H, Yamamoto T, et al. Household income is associated with food and nutrient intake in Japanese schoolchildren, especially on days without school lunch. Public Health Nutr. 2017;20:2946-58. doi: 10.1017/S1368980017001100.
10. Hur I, Jang MJ, Oh K. Food and nutrient intakes according to income in Korean men and women. Osong Public Health Res Perspect. 2011;2:192-7. doi: 10.1016/j.phrp.2011.11.044.
11. Oh H, Kim J, Huh Y, Kim SH, Jang SI. Association of household income level with vitamin and mineral intake. Nutrients. 2021;14:38. doi: 10.3390/nu14010038.
12. Ren Y, Li H, Wang X. Family income and nutrition-related health: evidence from food consumption in China. Soc Sci Med. 2019;232:58-76. doi: 10.1016/j.socscimed.2019.04.016.
13. Mori S, Asakura K, Sasaki S, Nishiwaki Y. Relationship between maternal employment status and children's food intake in Japan. Environ Health Prev Med. 2021;26:106. doi: 10.1186/s12199-021-01026-z.
14. Kaikkonen JE, Mikkila V, Raitakari OT. Role of childhood food patterns on adult cardiovascular disease risk. Curr Atheroscler Rep. 2014;16:443. doi: 10.1007/s11883-014-0443-z.
15. Summary of the situation in relation to childcare centers. Children and Families Agency; 2023. [cited 2026/1/24]; Available from: https://www.cfa.go.jp/policies/hoiku/torimatome/r5/ (in Japanese)

16. Standards for Equipment and Operation of Child Welfare Facilities. Ministry of Health, Labour and Welfare of Japan; 1948. [cited 2026/1/24]; Available from: https://www.mhlw.go.jp/web/t_doc?dataId=82069000&dataType=0&pageNo=1. (in Japanese)
17. Ministry of Health, Labour and Welfare of Japan. Dietary Reference Intakes for Japanese, 2020. Tokyo, Daiichi Publishing Ltd; 2020. (in Japanese)
18. Guidelines for Food Service in Child Care Facilities. Ministry of Health, Labour and Welfare of Japan; 2012. [cited 2026/1/24]; Available from: https://www.cfa.go.jp/policies/hoiku/shokuji-h24-bunkatsu/. (in Japanese)
19. Yoshiike N, Hayashi F, Takemi Y, Mizoguchi K, Seino F. A new food guide in Japan: the Japanese Food Guide Spinning Top. Nutr Rev. 2007;65:149-54. doi: 10.1111/j.1753-4887.2007.tb00294.x.
20. Standard tables of food composition in Japan-2015- (Seventh revised version). Ministry of Education, Culture, Sports Science and Technology; 2015. [cited 2026/1/24]; Available from: https://www.mext.go.jp/a_menu/syokuhinseibun/1365297.htm. (in Japanese)
21. Infant and Toddler Growth Assessment. Ministry of Health, Labour and Welfare of Japan; 2010. [cited 2026/1/24]; Available from: https://www.mhlw.go.jp/toukei/list/dl/73-22-01.pdf. (in Japanese)
22. Murata M. Nutritional diet guidance using growth curves and obesity curves learned from the basics. Tokyo, Daiichi Publishing Ltd; 2018. (in Japanese)
23. Abe A. Affluence and poverty: relative poverty and children (in Japanese). Jpn J Dev Psychol. 2012;23:362-74. doi: 10.11201/jjdp.23.362.
24. Yokoyama T. Theory and application of statistical methods to estimate the distribution of usual intakes of a nutrient in a population: For the appropriate use of dietary reference intakes. Jpn J Nutr Diet. 2013;71:S7-14. doi: 10.5264/eiyogakuzashi.71.S7. (in Japanese)
25. Tajima R, Murakami K, Asakura K, et al. Snacking in Japanese nursery school children aged 3-6 years: its characteristics and contribution to overall dietary intake. Public Health Nutr. 2021;24:1042-51. doi: 10.1017/S1368980019005007.
26. National Health and Nutrition Survey, 2019. Ministry of Health, Labour and Welfare of Japan; 2019. [cited 2026/1/24]; Available from: https://www.mhlw.go.jp/content/000711007.pdf. (in Japanese)
27. Cooke LJ, Wardle J, Gibson EL, Sapochnik M, Sheiham A, Lawson M. Demographic, familial and trait predictors of fruit and vegetable consumption by pre-school children. Public Health Nutr. 2004;7:295-302. doi: 10.1079/PHN2003527.
28. Cooke LJ, Wardle J. Age and gender differences in children’s food preferences. Br J Nutr. 2005;93:741-6. doi: 10.1079/bjn20051389.
29. Keller KL, Kling SMR, Fuchs B, et al. A biopsychosocial model of sex differences in children’s eating behaviors. Nutrients. 2019;11:682. doi: 10.3390/nu11030682.
30. Sakai A, Yoshita K, Takahashi T, et al. Evaluation of the relationship between household economic situation and food group intake in children attending nursery school. Nihon Kosyu eisei zasshi. 2024;71:220-30. doi: 10.11236/jph.23-059. (in Japanese)

31. National Health and Nutrition Survey, 2014. Ministry of Health, Labour and Welfare of Japan; 2016. [cited 2026/1/24]; Available from: https://www.mhlw.go.jp/bunya/kenkou/eiyou/dl/h26-houkoku.pdf. (in Japanese)
32. Horikawa C, Murayama N, Ishida H, et al. Nutrient adequacy of Japanese schoolchildren on days with and without a school lunch by household income. Food Nutr Res. 2020;64:5377. doi: 10.29219/fnr.v64.5377.
33. Murakami K, Okubo H, Livingstone MBE, et al. Adequacy of usual intake of Japanese children aged 3-5 years: A Nationwide Study. Nutrients. 2018;10:1150. doi: 10.3390/nu10091150.
34. Report on Public Health Administration and Services. Ministry of Health, Labour and Welfare of Japan; 2023. [cited 2026/1/24]; Available from: https://www.mhlw.go.jp/toukei/saikin/hw/eisei_houkoku/22/. (in Japanese)
35. Nozue M, Ishida H, Yoshita K, et al. Status of nutrition management dependent upon presence or absence of dietitians in childcare centers. Nihon Kosyu eisei zasshi. 2023;70:261-74. doi: 10.11236/jph.22-056. (in Japanese)
36. Murayama N, Yoneyama K. Food support project by food banks during the summer vacation for low-income households with children (in Japanese). Nihon kenko kyoiku gakkaishi. 2017;25:21-38. doi: 10.11260/kenkokyoiku.25.21.
37. Kachi Y, Kato T, Kawachi I. Socio-economic disparities in early childhood education enrollment: Japanese Population-Based Study. J Epidemiol. 2020;30:143-50. doi: 10.2188/jea.JE20180216.
38. Sakamoto T, Nozue M, Okabe T, et al. Association between household income and dietary changes in young children during the COVID-19 state of emergency in Japan from April to May 2020. Nihon kenko kyoiku gakkaishi. 2022;30:14. doi: 10.11260/kenkokyoiku.30.14. (in Japanese)

Table 1. The study procedure

	Boys				Girls			
	T1 (n=131)	T2 (n=139)	T3 (n=153)	p value	T1 (n=108)	T2 (n=116)	T3 (n=114)	p value
Equivalent income† (ten thousand yen)	202 (175, 246)	325 (291, 335)	400 (375, 417)	<0.001	205 (171, 225)	318 (291, 335)	400 (375, 433)	<0.001
Age (years)	4.0 (4, 5)	5.0 (4, 5)	5.0 (4, 5)	0.222	4.0 (4, 5)	4.0 (4, 5)	4.0 (4, 5)	0.901
Height (cm)	106 (100, 112)	107 (101, 112)	107 (102, 113)	0.360	104(100, 109)	105 (99, 110)	105 (100, 101)	0.690
Weight (kg)	17.5 (15.5, 19.5)	17.7 (15.6, 19.6)	17.8 (16.0, 19.4)	0.781	16.5 (15.1, 18.2)	16.4 (15, 18.6)	16.6 (15.1, 18.0)	0.972
Degree of obesity‡ (%)	0.2 (-4.1, 5.4)	-0.6 (-4.9, 5.5)	-0.1 (-5.3, 6)	0.680	-0.5 (-5.5, 6.2)	-0.3 (-5.6, 3.8)	-1.5 (-6.8, 3.2)	0.234
Region								
A	(11.5)	(7.9)	(10.5)	<0.001	(8.3)	(9.5)	(11.4)	0.019
B	(15.3)	(10.8)	(11.8)		(18.5)	(13.8)	(7.0)	
C	(16.8)	(12.2)	(35.3)		(8.3)	(19.8)	(21.9)	
D	(13.7)	(20.9)	(10.5)		(11.1)	(13.8)	(14.0)	
E	(9.2)	(25.2)	(21.6)		(15.7)	(17.2)	(25.4)	
F	(16.0)	(12.9)	(5.2)		(20.4)	(11.2)	(9.6)	
G	(17.6)	(10.1)	(5.2)		(17.6)	(14.7)	(10.5)	
Evaluation of degree of obesity‡								
<15%	(1.5)	(1.4)	(1.3)	0.969	(0.9)	(1.7)	(2.6)	0.827
-15% to 15%	(91.6)	(93.5)	(93.4)		(95.4)	(95.7)	(93.0)	
≧15％	(6.9)	(5.0)	(5.3)		(3.7)	(2.6)	(4.4)	
Food allergy								
Yes	(5.3)	(7.2)	(13.1)	0.052	(4.6)	(5.2)	(8.8)	0.375
No	(94.7)	(92.8)	(86.9)		(95.4)	(94.8)	(91.2)	
Household composition								
Single parent household	(8.4)	(0.0)	(0.7)	<0.001	(8.3)	(0.0)	(0.0)	<0.001
Living with parents	(71.0)	(84.9)	(99.3)		(75.0)	(87.1)	(98.2)	
Other living arrangement	(20.6)	(15.1)	(0.0)		(16.7)	(12.9)	(1.8)	
Educational background of father								
Less than high school	(9.9)	(3.6)	(2.0)	<0.001	(5.6)	(2.6)	(4.4)	<0.001
High school	(30.5)	(28.1)	(15.7)		(50.0)	(21.6)	(21.1)	
Vocational school	(22.9)	(15.8)	(15.7)		(16.7)	(19.0)	(13.2)	
Junior college	(3.8)	(3.6)	(0.7)		(1.9)	(3.4)	(0.9)	
University/graduate school	(32.8)	(48.9)	(66.0)		(25.9)	(53.4)	(60.5)	
Educational background of mother								
Less than high school	(3.8)	(0.0)	(1.3)	<0.001	(2.8)	(0.0)	(0.9)	<0.001
High school	(29.0)	(15.8)	(10.5)		(37.0)	(13.8)	(9.6)	
Vocational school	(26.0)	(17.3)	(20.3)		(27.8)	(26.7)	(17.5)	
Junior college	(19.1)	(20.9)	(13.1)		(14.8)	(18.1)	(14.9)	
University/graduate school	(22.1)	(46.0)	(54.9)		(17.6)	(41.4)	(57.0)	

Continuous variables are presented as median (25th, 75th percentiles), and categorical variables are presented as number (%).

p values were calculated using the Kruskal-Wallis test for continuous variables and the χ^2 test for categorical variables.
†Equivalent income was calculated by dividing household income by the square root of the number of household members.
‡Degree of obesity (%) = [Body weight (kg)- Standard body weight for height (kg)] / [Standard body weight for height (kg)] × 100..

Table 2. Comparison of energy and nutrient intakes across tertiles of equivalent income (boys)

	T1 (n=131)	T2 (n=139)	T3 (n=153)	p value[†]	p for trend[‡]
Energy (kcal)	1,440 (20)	1,430 (22)	1,440 (21)	0.883	0.542
Energy (kJ)	6,040 (85)	5,980 (93)	6,030 (89)		
Macronutrients					
Energy from protein (%)	13.7 (0.1)	14.0 (0.2)	14.5 (0.1)	<0.001[b]	<0.001
Energy from fat (%)	29.7 (0.4)	29.9 (0.4)	30.2 (0.4)	0.680	0.029
Energy from carbohydrate (%)	56.6 (0.4)	56.2 (0.5)	55.3 (0.5)	0.129	<0.001
Energy from SFA (%)	9.9 (0.2)	9.9 (0.2)	10.1 (0.2)	0.795	0.117
Protein (g)	49.2 (0.9)	49.8 (1.0)	52.0 (0.9)	0.072	<0.001
Fat (g)	48.1 (1.0)	48.2 (1.1)	48.9 (1.1)	0.834	0.055
SFA (mg)	16.0 (0.40)	16.1 (0.43)	16.4 (0.42)	0.775	0.084
Carbohydrates (g)	199 (3.0)	195 (3.3)	194 (3.1)	0.476	0.160
Dietary fiber (g)	12.4 (0.2)	12.0 (0.3)	12.6 (0.3)	0.267	0.968
Vitamins					
Vitamin A (μgRAE)	395 (19)	415 (21)	417 (21)	0.683	0.316
Vitamin D (mg)	4.6 (0.3)	5.2 (0.3)	5.1 (0.3)	0.255	0.012
Vitamin E (mg)	5.8 (0.2)	6.1 (0.2)	6.0 (0.2)	0.670	0.254
Vitamin K (mg)	121 (6)	138 (7)	129 (7)	0.195	0.147
Thiamin (mg)	0.74 (0.02)	0.73 (0.02)	0.74 (0.02)	0.890	0.741
Riboflavin (mg)	0.91 (0.02)	0.93 (0.03)	0.92 (0.03)	0.881	0.222
Niacin (mgNE)	9.6 (0.3)	9.6 (0.3)	10.3 (0.3)	0.164	0.003
Vitamin B-6 (mg)	0.87 (0.02)	0.87 (0.03)	0.88 (0.02)	0.979	0.132
Vitamin B-12 (mg)	3.3 (0.2)	3.6 (0.2)	3.8 (0.2)	0.218	<0.001
Folate (mg)	165 (5)	177 (5)	179 (5)	0.094	0.046
Pantothenic acid (mg)	4.17 (0.09)	4.28 (0.09)	4.36 (0.09)	0.317	0.055
Vitamin C (mg)	60 (3)	61 (3)	64 (3)	0.698	0.462
Minerals					
Sodium (g NaCL equivalent)	6.1 (0.1)	5.8 (0.1)	6.0 (0.1)	0.269	0.406
Potassium (mg)	1,600 (34)	1,680 (37)	1,700 (36)	0.096	0.019
Calcium (mg)	450 (16)	502 (17)	495 (16)	0.048	0.016
Magnesium (mg)	157 (3)	163 (4)	167 (4)	0.142	0.008
Iron (mg)	4.7 (0.1)	5.2 (0.1)	5.2 (0.1)	0.012 [a, b]	0.031
Phosphorus (mg)	752 (16)	776 (17)	795 (16)	0.156	0.002
Zinc (mg)	5.8 (0.1)	5.9 (0.1)	6.0 (0.1)	0.528	0.026
Copper (mg)	0.71 (0.01)	0.72 (0.02)	0.71 (0.01)	0.915	0.743

Adjusted estimated means (SE) are shown.
[†]Calculated using analysis of covariance, adjusted for regions, educational background of father and mother, and presence of food allergies as fixed factors,
and age and degree of obesity as covariates.
[‡]Calculated using multiple linear regression analyses with the same set of fixed factors and covariates.
[a]T1 vs. T2 (p <0.05), [b]T1 vs. T3 (p <0.05)

Table 3. Comparison of energy and nutrient intakes across tertiles of equivalent income (girls)

	T1 (n=131)	T2 (n=139)	T3 (n=153)	p value[†]	p for trend[‡]
Energy (kcal)	1,350 (20)	1,320 (20)	1,340 (21)	0.498	0.683
Energy (kJ)	5,640 (83)	5,510 (83)	5,600 (89)		
Macronutrients					
Energy from protein (%)	13.7 (0.2)	13.9 (0.2)	14.1 (0.2)	0.269	0.371
Energy from fat (%)	29.6 (0.4)	28.8 (0.4)	30.5 (0.4)	0.015	0.109
Energy from carbohydrate (%)	56.7 (0.4)	57.2 (0.4)	55.4 (0.5)	0.019	0.090
Energy from SFA (%)	9.8 (0.2)	9.4 (0.2)	10.3 (0.2)	0.006[b]	0.022
Protein (g)	46.1 (0.8)	45.9 (0.8)	47.0 (0.8)	0.621	0.853
Fat (g)	45.1 (0.9)	42.9 (0.9)	45.9 (1.0)	0.067	0.494
SFA (mg)	15.0 (0.36)	14.1 (0.35)	15.5 (0.38)	0.022	0.160
Carbohydrates (g)	186 (3.1)	182 (3.1)	181 (3.3)	0.574	0.256
Dietary fiber (g)	12.0 (0.3)	11.7 (0.3)	11.9 (0.3)	0.634	0.743
Vitamins					
Vitamin A (µgRAE)	377 (17)	374 (17)	400 (18)	0.535	0.097
Vitamin D (mg)	3.7 (0.3)	4.5 (0.3)	4.9 (0.3)	0.785	0.974
Vitamin E (mg)	5.6 (0.1)	5.6 (0.1)	5.7 (0.2)	0.729	0.196
Vitamin K (mg)	125 (6)	128 (6)	119 (6)	0.598	0.379
Thiamin (mg)	0.65 (0.02)	0.67 (0.02)	0.70 (0.02)	0.196	0.342
Riboflavin (mg)	0.81 (0.02)	0.82 (0.02)	0.86 (0.02)	0.227	0.115
Niacin (mgNE)	9.3 (0.2)	9.2 (0.2)	8.9 (0.3)	0.483	0.436
Vitamin B-6 (mg)	0.79 (0.02)	0.79 (0.02)	0.77 (0.02)	0.681	0.242
Vitamin B-12 (mg)	3.0 (0.2)	3.2 (0.2)	3.9 (0.2)	0.002[a,b]	0.003
Folate (mg)	157 (5)	163 (5)	166 (5)	0.402	0.188
Pantothenic acid (mg)	3.92 (0.08)	3.96 (0.08)	4.02 (0.09)	0.710	0.460
Vitamin C (mg)	56 (3)	62 (3)	59 (3)	0.305	0.143
Minerals					
Sodium (g NaCL equivalent)	5.8 (0.1)	5.6 (0.1)	5.7 (0.1)	0.311	0.725
Potassium (mg)	1,540 (32)	1,540 (32)	1,580 (34)	0.614	0.504
Calcium (mg)	409 (15)	413 (15)	468 (16)	0.013[a,b]	0.003
Magnesium (mg)	152 (3)	151 (3)	155 (3)	0.596	0.823
Iron (mg)	4.5 (0.1)	4.5 (0.1)	4.7 (0.1)	0.252	0.644
Phosphorus (mg)	698 (14)	702 (14)	733 (15)	0.197	0.195
Zinc (mg)	5.4 (0.1)	5.5 (0.1)	5.5 (0.1)	0.763	0.664
Copper (mg)	0.68 (0.01)	0.68 (0.01)	0.67 (0.01)	0.895	0.247

Adjusted estimated means (SE) are shown.
[†]Calculated using analysis of covariance, adjusted for regions, educational background of father and mother, and presence of food allergies as fixed factors,
and age and degree of obesity as covariates.
[‡]Calculated using multiple linear regression analyses with the same set of fixed factors and covariates.
[a]T1 vs. T3 ($p < 0.05$), [b]T2 vs. T3 ($p < 0.05$)

Table 4. Prevalence of inadequate nutrient intakes across tertiles of equivalent income (boys)

	T1 (n=131)	T2 (n=139)	T3 (n=153)	p value
Protein (% energy) †				
<13 or >20	43 (32.8)	26 (18.7)	13 (8.5)	<0.001
13-20	88 (67.2)	113 (81.3)	140 (91.5)	
Fat (% energy) †				
<20 or >30	66 (50.4)	80 (57.6)	88 (57.5)	0.392
20-30	65 (49.6)	59 (42.4)	65 (42.5)	
Carbohydrates (% energy) †				
<50 or >60	3 (2.3)	9 (6.5)	16 (10.5)	0.022
50-60	128 (97.7)	130 (93.5)	137 (89.5)	
SFA (% energy) †				
>10	58 (44.3)	70 (50.4)	83 (54.2)	0.243
≤10	73 (55.7)	69 (49.6)	70 (45.8)	
Dietary fiber (g) †				
<8	0 (0.0)	2 (1.4)	1 (0.7)	0.369
≥8	131 (100.0)	137 (98.6)	152 (99.3)	
Potassium (mg) †				
<1,400	26 (19.8)	23 (16.5)	11 (7.2)	0.006
≥1,400	105 (80.2)	116 (83.5)	142 (92.8)	
Sodium (g NaCL equivalent) †				
<3.5	131 (100.0)	138 (99.3)	152 (99.3)	0.635
≥3.5	0 (0.0)	1 (0.7)	1 (0.7)	
Vitamin A (μgRAE) ‡				
<350	41 (31.3)	33 (23.7)	20 (13.1)	<0.001
≥350	90 (68.7)	106 (76.3)	133 (86.9)	
Thiamin (mg) ‡				
<0.6	16 (12.2)	17 (12.2)	12 (7.8)	0.373
≥0.6	115 (87.8)	122 (87.8)	141 (92.2)	
Riboflavin (mg) ‡				
<0.7	18 (13.7)	9 (6.5)	20 (13.1)	0.103
≥0.7	113 (86.3)	130 (93.5)	133 (86.9)	
Niacin (mgNE) ‡				
<6	3 (2.3)	2 (1.4)	1 (0.7)	0.509
≥6	128 (97.7)	137 (98.6)	152 (99.3)	
Vitamin B-6 (mg) ‡				
<0.5	2 (1.5)	1 (0.7)	1 (0.7)	0.709
≥0.5	129 (98.5)	138 (99.3)	152 (99.3)	
Vitamin B-12 (μg) ‡				
<0.9	0 (0.0)	0 (0.0)	0 (0.0)	-
≥0.9	131 (100.0)	139 (100.0)	153 (100.0)	
Folate (μg) ‡				
<90	0 (0.0)	1 (0.7)	0 (0.0)	0.359
≥90	131 (100.0)	138 (99.3)	153 (100.0)	
Vitamin C (mg) ‡				
<40	20 (15.3)	20 (14.4)	11 (7.2)	0.067
≥40	111 (84.7)	119 (85.6)	142 (92.8)	
Calcium (mg) ‡				
<500	96 (73.3)	81 (58.3)	81 (52.9)	0.002
≥500	35 (26.7)	58 (41.7)	72 (47.1)	
Magnesium (mg) ‡				
<80	0 (0.0)	0 (0.0)	0 (0.0)	-
≥80	131 (100.0)	139 (100.0)	153 (100.0)	
Iron (mg) ‡				
<4.0	21 (16.0)	8 (5.8)	8 (5.2)	0.002
≥4.0	110 (84.0)	131 (94.2)	145 (94.8)	
Zinc (mg) ‡				
<3	0 (0.0)	1 (0.7)	0 (0.0)	0.359
≥3	131 (100.0)	138 (99.3)	153 (100.0)	
Copper (mg) ‡				
<0.3	0 (100.0)	0 (99.3)	0 (100.0)	-
≥0.3	131 (100.0)	139 (100.0)	153 (100.0)	

Values are presented as number (%).
p values were calculated using the χ2 test.
†Tentative Dietary Goal (DG) values for preventing lifestyle-related disease

‡Estimated Average Requirement (EAR) values according to the DRIs for Japanese, 2020.

.

Table 5. Prevalence of inadequate nutrient intakes across tertiles of equivalent income (girls)

	T1 (n=108)	T2 (n=116)	T3 (n=114)	p value
Protein (% energy) †				
<13 or >20	16 (14.8)	22 (19.0)	13 (11.4)	0.276
13-20	92 (85.2)	94 (81.0)	101 (88.6)	
Fat (% energy) †				
<20 or >30	42 (38.9)	44 (37.9)	66 (57.9)	0.003
20-30	66 (61.1)	72 (62.1)	48 (42.1)	
Carbohydrates (% energy) †				
<50 or >65	3 (2.8)	4 (3.4)	2 (1.8)	0.724
50-65	105 (97.2)	112 (96.6)	112 (98.2)	
SFA (% energy) †				
>10	36 (33.3)	42 (36.2)	60 (52.6)	0.006
≤10	72 (66.7)	74 (63.8)	54 (47.4)	
Dietary fiber (g) †				
<8	0 (0.0)	3 (2.6)	2 (1.8)	0.265
≥8	108 (100.0)	113 (97.4)	112 (98.2)	
Potassium (mg) †				
<1,400	22 (20.4)	30 (25.9)	22 (19.3)	0.435
≥1,400	86 (79.6)	86 (74.1)	92 (80.7)	
Sodium (g NaCL equivalent) †				
<3.5	107 (99.1)	113 (97.4)	114 (100.0)	0.185
≥3.5	1 (0.9)	3 (2.6)	0 (0.0)	
Vitamin A (μgRAE) ‡				
<350	45 (41.7)	48 (41.4)	33 (28.9)	0.078
≥350	63 (58.3)	68 (58.6)	81 (71.1)	
Thiamin (mg) ‡				
<0.6	29 (26.9)	28 (24.1)	19 (16.7)	0.167
≥0.6	79 (73.1)	88 (75.9)	95 (83.3)	
Riboflavin (mg) ‡				
<0.7	2 (1.9)	12 (10.3)	6 (5.3)	0.025
≥0.7	106 (98.1)	104 (89.7)	108 (94.7)	
Niacin (mgNE) ‡				
<6	3 (2.8)	2 (1.7)	0 (0.0)	0.222
≥6	105 (97.2)	114 (98.3)	114 (100.0)	
Vitamin B-6 (mg) ‡				
<0.5	0 (0.0)	0 (0.0)	0 (0.0)	-
≥0.5	108 (100.0)	116 (100.0)	114 (100.0)	
Vitamin B-12 (μg) ‡				
<0.9	0 (0.0)	0 (0.0)	0 (0.0)	-
≥0.9	108 (100.0)	116 (100.0)	114 (100.0)	
Folate (μg) ‡				
<90	0 (0.0)	0 (0.0)	0 (0.0)	-
≥90	108 (100.0)	116 (100.0)	114 (100.0)	
Vitamin C (mg) ‡				
<40	14 (13.0)	12 (10.3)	8 (7.0)	0.336
≥40	94 (87.0)	104 (89.7)	106 (93.0)	
Calcium (mg) ‡				
<500	81 (75.0)	83 (71.6)	59 (51.8)	<0.001
≥500	27 (25.0)	33 (28.4)	55 (48.2)	
Magnesium (mg) ‡				
<80	0 (0.0)	0 (0.0)	0 (0.0)	-
≥80	108 (100.0)	116 (100.0)	114 (100.0)	
Iron (mg) ‡				
<4.0	9 (8.3)	23 (19.8)	17 (14.9)	0.050
≥4.0	99 (91.7)	93 (80.2)	97 (85.1)	
Zinc (mg) ‡				
<3	0 (0.0)	0 (0.0)	0 (0.0)	-
≥3	108 (100.0)	116 (100.0)	114 (100.0)	
Copper (mg) ‡				
<0.3	0 (100.0)	0 (100.0)	0 (100.0)	-
≥0.3	108 (100.0)	116 (100.0)	114 (100.0)	

Values are presented as number (%).
p values were calculated using the $\chi 2$ test.
[†]Tentative Dietary Goal (DG) values for preventing lifestyle-related disease
[‡]Estimated Average Requirement (EAR) values according to the DRIs for Japanese, 2020.