Obesity in childhood and adolescence is a growing public health concern in many countries, including Japan (1). This obesity is associated with several risk factors for later heart disease and other chronic diseases, including hyperlipidemia, hyperinsulinemia, hypertension, and early atherosclerosis (2, 3). Further, it may also have an adverse effect on children and adolescents by reducing their health-related quality of life (4, 5). Investigation of modifiable lifestyle factors that influence obesity in children and adolescents is therefore a high priority.

The possible role of eating rate in promoting obesity has long been of interest. Eating slowly is often advised for weight management on the basis of the hypothesis that slower eating allows satiation to register before too much food is consumed (6), and a number of observational studies in free-living settings have consistently shown a positive association between rate of eating and measures of obesity in not only adults (7–11) but also children (12–14). However, previous epidemiologic studies in children (12–14) usually did not take into account for energy intake, macronutrient composition (i.e., protein, fat, and carbohydrate) or dietary fiber, hampering interpretation of whether or not eating rate is associated with measures of obesity independent of dietary intake or composition.

Here, using data from the Ryukyus Child Health Study (RYUCHS), Okinawa, Japan, we conducted a cross-sectional study of the association between rate of eating and the risk of overweight in a group of children and adolescents in Japan.

**MATERIALS AND METHODS**

**Study population.** RYUCHS was a school-based, cross-sectional, self-administered questionnaire survey conducted in Naha City and Nago City, Okinawa, Japan, between September 2004 and January 2005 (15). All public elementary and junior high schools in Naha City (n=35 and 17, respectively) and Nago City (n=17 and 8, respectively) participated in RYUCHS. This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the ethics committee of the Faculty of Medicine, Fukuoka University, Japan.
A detailed description of the study design and survey procedure has been published elsewhere (15).

A set of two self-administered questionnaires, a diet history questionnaire and a lifestyle questionnaire, were distributed by teachers to all elementary and junior high school students \( n = 38,212 \). Elementary school children were asked to have their parents answer the questionnaires with the active involvement of the child, while junior high school students were asked to answer the questionnaires by themselves, in cooperation with their parents if necessary. Answered questionnaires were checked by research technicians, and those with missing or illogical data were returned to the students. Of the 38,212 eligible students, 28,885 (75.6% of the eligible sample) participated in RYUCHS. Excluded from the present analysis were 3,581 students with incomplete data on the variables under study, and 1,128 who reported extremely low or high energy intake \( (< 625 - 1,225 \text{ or } > 2,475 - 4,650 \text{ kcal/d, depending on age and sex}) \) (15, 16). The final sample thus consisted of 24,176 students (63.3% of the eligible sample). For the present analysis they were grouped into four subpopulations, namely male children (boys aged 6–11 y; \( n = 7,956 \)), female children (girls aged 6–11 y; \( n = 8,018 \)), male adolescents (boys aged 12–15 y; \( n = 3,944 \)), and female adolescents (girls aged 12–15 y; \( n = 4,258 \)).

**Measurements.** Rate of eating was self-reported as part of the dietary questionnaire by an answer to the question ‘How fast is your rate of eating?’, chosen from five qualitative categories, namely very slow, relatively slow, medium, relatively fast, and very fast. In a previous validation study in female Japanese dietetic students, self-reported rate of eating showed a high level of agreement with friend-reported rate of eating, with percentages of exact and adjunct agreement of 46% and 47%, respectively (10).

Body weight and height were self-reported as part of the dietary questionnaire. Body mass index (BMI) was calculated as body weight (kg) divided by the square of body height \((\text{m}^2)\). Weight status was defined with the use of the International Obesity Task Force age- and sex-specific BMI cutoffs for children (17). Students with BMI values that corresponded to an adult BMI \( \approx 25 \frac{\text{kg}}{\text{m}^2} \) were classified as overweight, while all others were considered of normal weight.

The lifestyle questionnaire yielded information on paternal and maternal educational level, television or computer game use, and habitual exercise. Dietary habits during the preceding month were assessed using a brief self-administered diet history questionnaire for Japanese children and adolescents (BDHQCA) (18). The BDHQCA is a 4-page structured questionnaire that inquires about the consumption frequency of selected foods commonly consumed in Japan, general dietary behavior, and usual cooking methods. It was developed based on comprehensive (19–21) and brief (18, 22) versions of a validated self-administered diet history questionnaire for Japanese adults. Estimates of daily intake for foods (80 items in total), energy, and selected nutrients were calculated using an ad hoc computer algorithm for the BDHQCA, based on the Standard Tables of Food Composition in Japan (23). Values of nutrient intake were energy-adjusted using the density method (i.e., percentage of energy for energy-providing nutrients and amount per 1,000 kcal of energy for dietary fiber). The validity of the BDHQCA has been published elsewhere, in terms of selected fatty acids and carotenoids using biomarkers (erythrocyte fatty acids and serum carotenoids) as the gold standard (18).

**Statistical analyses.** All statistical analyses were performed for male children, female children, male adolescents, and female adolescents separately using SAS statistical software (version 9.1, 2003, SAS Institute Inc, Cary, NC, USA). Using logistic regression analysis, crude and multivariate adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for overweight for each rate of eating category were calculated, with the medium category used as a reference category. Multivariate adjusted ORs were calculated by adjusting for potential confounding factors, including age (y, continuous), paternal educational level (junior high school; high school; junior college or vocational technical school; or university), maternal educational level (junior high school; high school; junior college or vocational technical school; or university), municipality (Naha City or Nago City), television or computer game use (<2 h/d, 2–3 h/d, or >3 h/d), habitual exercise (none, \( \leq 2 \text{ times/wk} \), 3–4 times/wk, or \( \geq 5 \text{ times/wk} \)), protein intake (% of energy, continuous), fat intake (% of energy, continuous), and dietary fiber intake \((\text{g}/1,000 \text{ kcal, continuous})\). We did not conduct adjustment for dietary glycemic load, a variable significantly associated with the prevalence of overweight in this population, because of extremely high correlation between dietary fat intake and glycemic load (Pearson correlation coefficient: \( > -0.93 \) ) (15). Trends of association were assessed by a logistic regression model which assigned consecutive integers to the levels of the independent variable. All reported \( p \) values are 2-tailed, and \( p \) values of \(< 0.05 \) were considered statistically significant.

**RESULTS**

The prevalence of overweight was 15.2% for male children (6- to 11-y-old boys), 12.8% for female children (6- to 11-y-old girls), 14.5% for male adolescents (12- to 15-y-old boys), and 8.9% for female adolescents (12- to 15-y-old girls) (overall prevalence: 13.2%). Characteristics of participants according to weight status have been published elsewhere (15).

Characteristics of participants according to category of rate of eating are shown in Table 1. In all subpopulations, rate of eating was positively associated with age, except in female adolescents. In male adolescents only, rate of eating was negatively associated with paternal educational level. In female children and male adolescents, rate of eating was positively associated with television or computer game use. In male and female children, rate of eating was positively associated with habitual exercise. In all subpopulations, rate of eating was positively associated with energy intake and
| Boys aged 6–11 y (n=7,956) | Girls aged 6–11 y (n=8,018) | Boys aged 12–15 y (n=3,944) | Girls aged 12–15 y (n=4,258) |
|-------------------------|-----------------------------|-----------------------------|-----------------------------|
| **n**                   |                             |                             |                             |
| 469                     | 702                         | 118                         | 210                         |
| Age (y)                 |                             |                             |                             |
| 8.3                     | 8.3                         | 13.2                        | 13.3                        |
| Body height (m)         |                             |                             |                             |
| 1.26                    | 1.26                        | 1.26                        | 1.26                        |
| Body weight (kg)        |                             |                             |                             |
| 25.4                    | 25.5                        | 43.7                        | 43.7                        |
| Body mass index (kg/m²) |                             |                             |                             |
| 15.8                    | 15.8                        | 17.9                        | 18.8                        |
| Paternal educational level (%) |                     |                             |                             |
| Junior high school      |                             |                             |                             |
| 5.3                     | 6.7                         | 2.5                         | 8.6                         |
| High school             |                             |                             |                             |
| 42.9                    | 44.6                        | 50.0                        | 41.0                        |
| Junior college or vocational technical school |                             |                             |                             |
| 16.4                    | 14.8                        | 11.0                        | 17.6                        |
| University              |                             |                             |                             |
| 35.4                    | 34.5                        | 36.4                        | 32.9                        |
| Maternal educational level (%) |                     |                             |                             |
| Junior high school      |                             |                             |                             |
| 4.1                     | 4.6                         | 5.1                         | 5.1                         |
| High school             |                             |                             |                             |
| 39.2                    | 42.9                        | 44.1                        | 41.9                        |
| Junior college or vocational technical school |                             |                             |                             |
| 44.1                    | 42.0                        | 36.4                        | 42.4                        |
| University              |                             |                             |                             |
| 12.6                    | 10.5                        | 14.4                        | 10.5                        |
| Municipality (%)        |                             |                             |                             |
| Naha City               |                             |                             |                             |
| 87.2                    | 84.6                        | 82.2                        | 83.8                        |
| Nago City               |                             |                             |                             |
| 12.8                    | 15.4                        | 17.8                        | 16.2                        |
| Television or computer game use (%) |                     |                             |                             |
| ≤2 h/d                  |                             |                             |                             |
| 23.9                    | 37.6                        | 21.2                        | 28.1                        |
| >3 h/d                  |                             |                             |                             |
| 33.1                    | 30.6                        | 30.5                        | 24.8                        |
| Habitual exercise (%)   |                             |                             |                             |
| None                    |                             |                             |                             |
| 33.1                    | 49.3                        | 17.0                        | 38.6                        |
| ≤2 times/wk             |                             |                             |                             |
| 33.1                    | 35.9                        | 14.4                        | 16.2                        |
| >3 times/wk             |                             |                             |                             |
| 19.8                    | 9.5                         | 16.1                        | 11.0                        |
| Energy intake (kcal/d)  |                             |                             |                             |
| 1.823                   | 1.623                       | 2.045                       | 1.725                       |
| Nutrient intake         |                             |                             |                             |
| Protein (% of energy)   |                             |                             |                             |
| 14.3                    | 14.3                        | 14.0                        | 14.6                        |
| Fat (% of energy)       |                             |                             |                             |
| 29.0                    | 29.4                        | 28.0                        | 29.1                        |
| Carbohydrate (% of energy) |                      |                             |                             |
| 55.5                    | 55.1                        | 56.5                        | 55.1                        |
| Dietary fiber (g/1,000 kcal) |                      |                             |                             |
| 5.8                     | 5.9                         | 5.4                         | 6.1                         |

1 Data for the categories of relatively slow and relatively fast are not shown for simplicity. Values are means unless otherwise indicated.
2 For continuous variables, a linear trend test was used; for categorical variables, a Mantel-Haenszel chi-square test was used.
Table 2. Odds ratios and 95% confidence intervals for overweight according to rate of eating in Japanese children and adolescents from the Ryukyu Child Health Study, Okinawa, Japan.1

| Rate of Eating          | Boys aged 6–11 y (n=7,956) | Girls aged 6–11 y (n=702) | Boys aged 12–15 y (n=1,301) | Girls aged 12–15 y (n=2,393) |
|-------------------------|-----------------------------|---------------------------|-----------------------------|--------------------------------|
|                         | Prevalence (%)              | Prevalence (%)            | Prevalence (%)              | Prevalence (%)                  |
| Very slow               | 6.4                         | 0.13 (0.03, 0.54)         | 1.7                         | 0.58 (0.30, 1.01)               |
| Relatively slow         | 7.3                         | 0.46 (0.40, 0.60)         | 1.9                         | 0.47 (0.34, 0.66)               |
| Medium                  | 13.5                        | 0.50 (0.34, 0.69)         | 2.3                         | 1.31 (1.04, 1.62)               |
| Relatively fast         | 29.1                        | 0.86 (0.68, 1.08)         | 4.8                         | 2.12 (1.26, 3.55)               |
| Very fast               | 46.9                        | 2.81 (2.42, 3.26)         | 12.9                        | 6.21 (4.29, 9.18)               |

Crude model

| Rate of Eating          | Boys aged 6–11 y (n=7,956) | Girls aged 6–11 y (n=702) | Boys aged 12–15 y (n=1,301) | Girls aged 12–15 y (n=2,393) |
|-------------------------|-----------------------------|---------------------------|-----------------------------|--------------------------------|
|                         | Prevalence (%)              | Prevalence (%)            | Prevalence (%)              | Prevalence (%)                  |
| Very slow               | 6.4                         | 0.13 (0.03, 0.54)         | 1.7                         | 0.58 (0.30, 1.01)               |
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| Very fast               | 46.9                        | 2.81 (2.42, 3.26)         | 12.9                        | 6.21 (4.29, 9.18)               |

Multivariate model

| Rate of Eating          | Boys aged 6–11 y (n=7,956) | Girls aged 6–11 y (n=702) | Boys aged 12–15 y (n=1,301) | Girls aged 12–15 y (n=2,393) |
|-------------------------|-----------------------------|---------------------------|-----------------------------|--------------------------------|
|                         | Prevalence (%)              | Prevalence (%)            | Prevalence (%)              | Prevalence (%)                  |
| Very slow               | 6.4                         | 0.13 (0.03, 0.54)         | 1.7                         | 0.58 (0.30, 1.01)               |
| Relatively slow         | 7.3                         | 0.46 (0.40, 0.60)         | 1.9                         | 0.47 (0.34, 0.66)               |
| Medium                  | 13.5                        | 0.50 (0.34, 0.69)         | 2.3                         | 1.31 (1.04, 1.62)               |
| Relatively fast         | 29.1                        | 0.86 (0.68, 1.08)         | 4.8                         | 2.12 (1.26, 3.55)               |
| Very fast               | 46.9                        | 2.81 (2.42, 3.26)         | 12.9                        | 6.21 (4.29, 9.18)               |

\[ \text{Odds ratio (OR)} = \frac{\text{Prevalence of overweight in the fast rate}}{\text{Prevalence of overweight in the slow rate}} \]

To our knowledge, this is the first study to examine the relation of rate of eating with weight status in not only adolescents but also children, with consideration given to macronutrient composition and dietary fiber intake. Consistent with previous studies (7–14), we identified a positive relationship between the rate of eating and overweight in Japanese children and adolescents. This association was independent of not only non-dietary factors but also macronutrient composition and dietary fiber intake. The mechanism linking a higher rate of eating and overweight has been speculated to involve increasing energy intake; hence, we did not adjust for energy intake in our analysis. In the present study, underreporting of energy intake, assessed based on the ratio of reported energy intake to estimated energy requirement, was prevalent, particularly in overweight subjects (15). Nonetheless, a higher rate of eating was associated with not only an increased risk of overweight but also a higher energy intake. This suggests that energy intake may play a mediating role in the association between eating rate and overweight.

Several limitations of the present study warrant mention. First, the cross-sectional nature of the study does not permit the assessment of causality owing to the uncertain temporality of the association. We cannot rule out the possibility that the association between rate of eating and overweight observed here was the result of post hoc changes in dietary behavior (in a healthier direction) as a consequence of overweight. This may be particularly relevant in female populations, given the excessive weight concerns observed in young Japanese women (24, 25). These concerns may explain why the association was relatively weak in female adolescents. A prospective study or trial should be undertaken to better understand the relation between rate of eating and weight status in children and adolescents.

Second, only 63.3% of the eligible sample were...
included in the present analysis, suggesting that selection bias might have been inevitable. Additionally, the distribution of various lifestyle and environmental factors in Okinawa, where the present study was conducted, may differ from those elsewhere in Japan as well as in other parts of the world, and the results may accordingly not apply to other populations.

Third, we used the self-reported rate of eating, the validity of which may have influenced the observed results. Although a high level of agreement between self- and friend-reported eating rate has been observed in female Japanese dietetic students (9), validity in children and adolescents is presently unknown. A more valid measure of the rate of eating is required.

Fourth, we used BMI as a proxy measure for body fatness, which can be misleading at the individual level (26). A more valid measure of body fat mass (e.g., dual energy X-ray absorptiometry) may be required. More importantly, BMI was calculated from self-reported body weight and height, which might be biased. Previous studies have consistently shown that on average, self-reported weights are underestimated, heights are overestimated, and the resultant BMIs are underestimated, although the correlations between self-reported and measured values are strongly high (27–29). It is therefore likely that the prevalence of overweight based on self-reported data in this study was underestimated, which may have influenced the results by attenuating the association.

Fifth, we used a self-administered dietary assessment questionnaire (i.e., BDHQCA) to estimate intakes of macronutrients and dietary fiber, important adjustment factors in this study. Thus, actual dietary habits were not observed. Also, the validity of BDHQCA regarding these nutrients is unknown, notwithstanding that the comprehensive and brief versions of the diet history questionnaire for adults, from which the BDHQCA was developed, have been well validated not only for these but also for commonly studied nutritional variables (19–22, 30). Further, misreporting of dietary intake is an ongoing controversy in studies that collect dietary information using self-report instruments (31), and underreporting of energy intake was actually common in this study (15). Thus, the results should be interpreted with caution. Nevertheless, to minimize the influence of dietary misreporting, we used energy-adjusted values of protein, fat, and dietary fiber in the main analysis (a common procedure in nutritional epidemiology (32)), based on the finding that while dietary misreporting is strongly associated with BMI, BMI-dependent misreporting seems to be canceled by energy-adjustment, at least for protein, potassium, and sodium (33).

Finally, although we adjusted for a variety of potential confounding variables, residual confounding could not be ruled out. In particular, we could not control for puberty status or parental weight status because of a lack of information.

In summary, this large cross-sectional study in Japan showed that a higher rate of eating was independently positively associated with an increasing risk of overweight in children and adolescents. Eating slowly might be an effective strategy for preventing overweight in children and adolescents. We acknowledge the need to confirm our findings by additional prospective studies and intervention trials with a more rigorous assessment of rate of eating and body fatness.

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REFERENCES

1) Matsuhashi Y, Yoshiike N, Kaneda F, Yoshita K, Takimoto H. 2004. Trends in childhood obesity in Japan over the last 25 years from the national nutrition survey. J Obes Res 12: 205–214.
2) Berenson GS, Srinivasan SR, Bao W, Newman WP 3rd, Tracy RE, Wattigney WA. 1998. Association between multiple cardiovascular risk factors and atherosclerosis in children and young adults. The Bogalusa Heart Study. N Engl J Med 338: 1650–1656.
3) Mahoney LT, Burns TL, Stanford W, Thompson BH, Witt JD, Rost CA, Lauer RM. 1996. Coronary risk factors measured in childhood and young adult life are associated with coronary artery calcification in young adults: The Muscatine Study. J Am Coll Cardiol 27: 277–284.
4) Williams J, Wake M, Hesketh K, Maher E, Waters E. 2005. Health-related quality of life of overweight and obese children. JAMA 293: 70–76.
5) Swallen KC, Reither EN, Haas SA, Meier AM. 2005. Overweight, obesity, and health-related quality of life among adolescents: the National Longitudinal Study of Adolescent Health. Pediatrics 115: 340–347.
6) Andrade AM, Greene GW, Melanson KJ. 2008. Eating slowly led to decreases in energy intake within meals in healthy women. J Am Diet Assoc 108: 1186–1191.
7) Ortega RM, Redondo MR, Lopez-Sobaler AM, Quintas ME, Zamora MJ, Andres P, Encinas-Sotillos A. 1996. Associations between obesity, breakfast-time food habits and intake of energy and nutrients in a group of elderly Madrid residents. J Am Coll Nutr 15: 65–72.
8) Gerace TA, George VA. 1996. Predictors of weight increases over 7 years in fire fighters and paramedics. Prev Med 25: 593–600.
9) Sasaki S, Katagiri A, Tsuji T, Shimoda T, Amano K. 2003. Self-reported rate of eating correlates with body mass index in 18-y-old Japanese women. Int J Obes Relat Metab Disord 27: 1405–1410.
10) Otsuka R, Takamakshi K, Yatsuha Y, Murata C, Sekiya A, Wada K, Zhang HM, Matsushita K, Sugiuara K, Takefuji S, OnYang P, Nagasawa N, Kondo T, Sasaki S, Toyoshima H. 2006. Eating fast leads to obesity: findings based on self-administered questionnaires among middle-aged Japanese men and women. J Epidemiol 16: 117–124.
11) Muruyama K, Sato S, Ohira T, Maeda K, Noda H, Kubota Y, Nishimura S, Kitamura A, Kiyama M, Okada T, Imano H, Nakamura M, Ishikawa Y, Karukawa M, Sasaki S, Iso H. 2008. The joint impact of self-reported behaviors of eating quickly and eating until full on overweight;
results of a cross sectional survey. BMJ 337: a2002.
21) Sun Y, Sekine M, Kagamimori S. 2009. Lifestyle and overweight among Japanese adolescents: the Toyama Birth Cohort Study. J Epidemiol 19: 303–310.
22) Webber L, Hill C, Saxton J, Van Jaarsveld CHM, Wardle J. 2009. Eating behaviour and weight in children. Int J Obes 33: 21–28.
23) Sugimori H, Yoshida K, Izuno T, Miyakawa M, Suka M, Sekine M, Yamagami T, Kagamimori S. 2004. Analysis of factors that influence body mass index from ages 3 to 6 years: A study based on the Toyama cohort study. Pediatr Int 46: 302–310.
24) Ministry of Health, Labour and Welfare of Japan. 2009. Dietary Reference Intakes for Japanese, 2010. Daiichi Shuppan Publishing, Tokyo.
25) Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. 2000. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ 320: 1240–1243.
26) Okuda M, Sasaki S, Bando N, Hashimoto M, Kunitzugu I, Sugiyama S, Terao J, Hobara T. 2009. Carotenoid, tocopherol, and fatty acid biomarkers and dietary intake estimated by using a brief self-administered diet history questionnaire for older Japanese children and adolescents. J Nutr Sci Vitaminol 55: 231–241.
27) Sasaki S, Yanagibori R, Amano K. 1998. Self-administered diet history questionnaire developed for health education: a relative validation of the test-version by comparison with 3-day diet record in women. J Epidemiol 8: 203–215.
28) Sasaki S, Uschio F, Amano K, Morihara M, Todoriki T, Uehara Y, Toyooka T. 2000. Serum biomarker-based validation of a self-administered diet history questionnaire for Japanese subjects. J Nutr Sci Vitaminol 46: 285–296.
29) Murakami K, Sasaki S, Takahashi Y, Okubo H, Hirota N, Notsu A, Fukui M, Date C. 2008. Reproducibility and relative validity of dietary glycemic index and load assessed with a self-administered diet-history questionnaire in Japanese adults. Br J Nutr 99: 639–648.
30) Kobayashi S, Murakami K, Sasaki S, Okubo H, Hirota N, Notsu A, Fukui M, Date C. 2011. Comparison of relative validity for food group intake estimated by comprehensive and brief-type self-administered diet history questionnaires against 16-day dietary records in Japanese adults. Public Health Nutr 14: 1200–1211.
31) Science and Technology Agency. 2005. Standard Tables of Food Composition in Japan, 5th Revised and Enlarged Ed. Printing Bureau of the Ministry of Finance, Tokyo (in Japanese).
32) Hayashi F, Takimoto H, Yoshita K, Yoshikke N. 2006. Perceived body size and desire for thinness of young Japanese women: a population-based survey. Br J Nutr 96: 1154–1162.
33) Huybrechts I, De Bacquer D, Van Trimpont I, De Backer G, De Henauw S. 2006. Validity of parentally reported weight and height for preschool-aged children in Belgium and its impact on classification into body mass index categories. Pediatrics 118: 2109–2118.
34) Goodman E, Hinden BR, Khandelwal S. 2000. Accuracy of teen and parental reports of obesity and body mass index. Pediatrics 106: 52–58.
35) Kobayashi S, Honda S, Murakami K, Sasaki S, Okubo H, Hirota N, Notsu A, Fukui M, Date C. 2012. Both comprehensive and brief self-administered diet history questionnaires satisfactorily rank nutrient intakes in Japanese adults. J Epidemiol 22: 151–159.
36) Livingstone MBE, Black AE. 2003. Markers of the validity of reported energy intake. J Nutr 133: 895S–920S.
37) Willett WC. 1998. Nutritional Epidemiology, 2nd ed. Oxford University Press, New York.
38) Murakami K, Sasaki S, Takahashi Y, Uenishi K, Yanagibori R, Miyakawa M, Suka M, Hayabuchi H, Goda T, Oka J, Baba K, Ohki K, Kohri T, Watanabe R, Sugiyama Y. 2008. Misreporting of dietary energy, protein, potassium and sodium in relation to body mass index in young Japanese women. Eur J Clin Nutr 62: 111–118.