Original Article

Identification of dietary patterns and their relationships with general and oral health in the very old

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Little is known about the dietary patterns of Asian populations aged ≥85 years and their associated factors. Thus, we aimed to (1) identify these dietary patterns and (2) clarify the relationships between the dietary pattern and health outcomes in a community-dwelling very old population. The Tokyo Oldest Old Survey on Total Health study is an observational cohort study comprising 512 Japanese subjects (women, n=288; men, n=224; age, 87.8±2.2 years). Dietary patterns were assessed by principal component analysis using a brief self-administered diet history questionnaire. Barthel index, Mini-Mental State Examination, and oral health status [maximum occlusal force (MOF), denture use, and dentulous / edentulous state] were also measured. Two dietary patterns were identified. The first factor component "traditional Japanese" was characterized by a high consumption of vegetables, seaweed, legumes, and fish. The second factor component "noodles and confectioneries" was characterized by a high consumption of noodles, confectioneries, and non-alcoholic beverages. Multivariable analysis showed that the "traditional Japanese" dietary pattern was inversely associated with dentulous state (OR: 0.53; 95% CI: 0.34–0.82), the lowest tertile of MOF (OR: 0.64; 95% CI: 0.42–0.99), and denture use (OR: 2.42; 95% CI: 1.26–4.63) even after adjustment for potential confounders. Furthermore, the "noodles and confectioneries" dietary pattern was inversely associated with the lowest tertile of MOF (OR: 0.62; 95% CI: 0.40–0.94). However, there were no significant associations between these dietary patterns and disability or cognitive function. We identified two dietary patterns in the very old population, which were associated with oral health status.

Key Words: food choice, Japan, oral function, principal component analysis, very old

INTRODUCTION

Because of the increasing life expectancy and population of elderly throughout the world,[1] there is an urgent need to maintain the quality of life (QOL). Lifestyle modifications, including nutritional and physical activity interventions, reduce the risk of frailty,[2,3] and these are associated with QOL or mortality[4,5] and linked to the extended healthy life expectancy. Understanding dietary habits is essential for the planning of effective dietary interventions by healthcare providers. Particularly, attention has been paid to exposure to dietary patterns rather than exposure to single nutrients and foods, because complex interactions may exist among foods and nutrients, and people usually do not consume single nutrients or foods.[6] Recent studies have identified dietary patterns[6] and associations between dietary patterns and various outcomes, including all causes and cardiovascular disease mortality or cognitive decline.[7-9] Dietary patterns have been previously identified in Japanese adults[8,10-12] and shown to be associated with preventive effects on the risk of mortality, disability, and cognitive decline in a wide range of generations (ranging from early 20s to early 80s) and areas.[8,13,14] However, no data are available on the dietary patterns in the very old population, which is defined as individuals aged ≥85 years. In Europe, the Newcastle 85+ research group previously assessed the energy and nutrient intake in a very old population,[15] but information about dietary patterns was still lacking. Dietary patterns appear to vary with ethnicity;[16] thus, the dietary patterns of the Caucasians may differ from those of the Japanese.

We conducted a cross-sectional study to identify the

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dietary patterns in the very old Japanese population using a posteriori method in the present study. In addition, we investigated the association between the identified dietary patterns and health-related outcomes, including disability, cognitive decline, and oral health status.

MATERIALS AND METHODS

Study population

Tokyo Oldest Old Survey on Total Health (TOOTH) study, a prospective observational cohort study, is designed to investigate the overall health of a community-dwelling very old Japanese population using an interdisciplinary approach involving gerontological, dental, psychological, gerontechnological, nutritional, and epidemiological components.[17] TOOTH study includes a total of 542 participants (women, n=306; men, n=236; age, 87.8±2.2 years) subjected to hospital- and/or home-based examinations at baseline. We excluded eight participants with missing data for dietary intake and 22 participants with a total energy intake of >3,000 kcal/day among women and >3,750 kcal/day among men because of possible overestimation.[18] Finally, we included 512 participants (women, n=288; men, n=224; age, 87.8±2.2 years) in the present analysis. This study was approved by the Ethics Committees at Keio University School of Medicine (No. 19-47, 2007), and written informed consent was obtained from all participants. TOOTH study was registered in the University Hospital Medical Information Network Clinical Trial Registry under ID UMIN000001842.

Assessment of dietary intake

Dietary habits during the previous month were assessed using a brief self-administered diet history questionnaire (BDHQ). The questionnaire determined the consumption frequency of 56 foods and beverages and nine dishes comprising typical Japanese foods such as rice, fermented soybeans (natto), misosoup, and green tea. The dietary intake in terms of energy and nutrients was estimated by reference to the 5th edition of the Standard Tables of Food Composition in Japan.[19] Participants were asked to complete the BDHQ questionnaire by themselves. However, because of cognitive function or other functional limitations, 87 participants (women, n=45; men, n=42) were allowed to complete the form with the assistance of proxies, who were acquainted with their daily dietary habits.[18] The questionnaire was previously validated in this population.[18]

Assessment of general characteristics, anthropometric variables, and physical, psychological, cognitive health-related variables, and medical information

General characteristics of the participants were assessed through face-to-face interviews. Education, living arrangements, smoking and drinking habits, physical activity level,[20] and medical history were determined during the interviews. Medical information was obtained based on personal interviews and clinic- or home-based medical examinations by well-trained geriatricians. Disease classification was based on *International Classification of Diseases, Tenth Revision.* Seven chronic conditions [hypertension (I10), heart disease (I20–I22, I25, I48, I50, and Z95.0), stroke (I60–I69), type 2 diabetes mellitus (E11), hyperlipidemia (E78), renal disease (N00–N19), and dementia (F00–F09)] were included in the comorbidity count.[21]

Height and body weight were measured while wearing light clothes and standing upright before calculating the body mass index (BMI, kg/m^2). Furthermore, we evaluated the activity of daily living (ADL) using the Barthel index (BI)[22] and cognitive function using the Mini-Mental State Examination (MMSE).[23] BI comprises 10 items, including self-care and mobility, wherein the scores range from 0 to 100 (0: fully dependent, 100: fully independent). MMSE comprises 11 questions and yields scores ranging from 0 to 30. An MMSE cutoff score of 24 was used in clinical settings to detect cognitive impairment. Number of remaining teeth, use of dentures, and maximum occlusal force (MOF) were measured by well-trained dentists to assess the oral health status of participants, as previously described.[24]

Statistical analysis

To identify dietary patterns of the community-dwelling very old population in Japan, we performed principal component analysis (PCA), which has been used widely in dietary pattern analysis as a posteriori method.[6]First, we used energy-adjusted variables (g/1,000 kcal) and examined whether normality could be assumed based on skewness and kurtosis, and whether each variable included a zero score. To normalize the distributions, natural log transformation was applied to the variables if the skewness or kurtosis of the variables was >2.0 or <−2.0.[25] If a zero score was included in the variables, we added 0.5 to a fixed number prior to the natural log transformation ($\log e_{(x + 0.5)}$).[26] Second, we needed to reduce the maximum number of variables from 56 to 50 for balancing the number of variables and the sample size (<10 variables per participant);[27] therefore, the correlation and PCA among variables were performed within each of the food groups classified in BDHQ (15 food groups). Based on the results of these analyses and food consumption, some of the food variables were summed. Subsequently, new variables were created, i.e., noodles, alcoholic beverages, fruits, and milk. Finally, 48 variables were included in the PCA.

The exploratory PCA with orthogonal varimax rotation was performed using 48 variables. The scree plots dropped substantially after the second and sixth factor, and the eigenvalues of the first to 15th factors were >1. Based on both the eigenvalues and scree plot results, we considered the interpretability of the factors to determine the number of factor components. Next, we determined two factors and the factor scores were calculated by summing the food item intakes weighted by their factor loading values. Food variables with factor loading coefficients >0.2 or <−0.2 were considered for the interpretation of each factor. After confirming that the assumption of normality was satisfied using the Kolmogorov–Smirnov test, the participants were dichotomized based on the median values for each factor score.

Data for all participants were expressed as mean±SD, median (interquartile), or percentage. Assumptions of normality and equal variance were tested using the Kolmogorov–Smirnov and Levene tests, respectively. For group comparisons, the unpaired *t*-test was performed for continuous variables and the chi-squared test was performed for categorical variables. If data were skewed, the Mann–Whitney U test was performed for continuous variables.

Multivariable logistic regression analyses were performed to test the relationship between the dietary pattern and BI, MMSE, or oral health status, including MOF, dentulous state (having natural teeth), and denture use. We divided the dietary patterns into two groups according to the median values of the factor scores for each factor. We set the outcome variables as follows: BI, <80 points (moderate to severe dependence);[28,29] MMSE, <24 points (cognitive impairment); and MOF, <9.8 kg in men and <6.7 kg in women based on the lowest tertile stratified by sex. We used the previously reported cutoff point for the lowest tertile of MOF.[24] The analysis was adjusted for different variables in two models. Model 1 was adjusted by sex, age, and BMI. Model 2 included adjustments for living arrangements [living alone or living with family member(s)], education years (as a continuous variable), current smoker (yes or no), drinking status (currently drinking, former, or never), physical activity level (as a continuous variable), and comorbidity status (number of morbidities; 0–7) in addition to those in Model 1.

All analyses were performed using IBM SPSS version 22.0 for Macintosh (SPSS, Inc., Tokyo, Japan). All the *p*-values for statistical tests were two-tailed and $p<0.05$ was considered statistically significant.

Table 1. Factor loading matrix for dietary patterns identified by principal component analysis

	First factor component "traditional Japanese"	Second factor component "noodles and confectioneries"
Cooking oil	0.81	−0.11
Cooking salt	0.79	−0.31
Japanese radish/turnip	0.64	−0.05
Cabbage/Chinese cabbage	0.62	−0.07
Carrots/pumpkin	0.61	−0.09
Mushrooms	0.58	0.24
Other root vegetables	0.58	−0.06
Green leafy vegetables	0.58	0.12
Cooking sugar	0.55	−0.42
Seaweed	0.54	0.03
Tofu/deep fried tofu	0.46	−0.09
Lettuce/cabbage (raw)	0.44	0.22
Lean fish	0.40	0.20
Tomatoes	0.40	0.22
Small fish with bones	0.38	0.08
Potatoes	0.36	−0.14
Pickled green leafy vegetables	0.36	0.04
Dried fish/salted fish	0.34	0.14
Western-type confectioneries	−0.32	0.22
Oily fish	0.31	0.09
Natto	0.27	0.00
Other pickled vegetables	0.19	−0.01
Chicken	0.18	0.18
Fruit	0.15	0.00
Bread	−0.15	0.10
Rice	−0.30	−0.53
Soup for noodles	0.02	0.51
Noodles	0.07	0.48
Sugar	−0.11	0.45
Cola drink/Soft drink	−0.18	0.42
Black tea/Oolong tea	0.06	0.40
Green tea	0.11	−0.40
Coffee	−0.02	0.40
Miso soup	−0.08	−0.34
100% fruit and vegetable juice	−0.01	0.33
Ice cream	−0.06	0.33
Ham/sausage/bacon	0.15	0.32
Rice crackers/Rice cake/Okonomiyaki	−0.11	0.32
Mayonnaise/dressing	0.27	0.32
Squid/octopus/shrimp/shellfish	0.28	0.30
Japanese-type confectioneries	−0.11	0.29
Soy sauce/soy	−0.19	−0.27
Canned tuna	0.18	0.19
Egg	0.03	−0.19
Liver	0.13	0.14
Alcoholic beverages	−0.09	0.10
Milk and yogurt	−0.06	−0.10
Pork and beef	0.03	0.05

RESULTS

Table 1 shows the factor loading scores (Kaiser–Mayer–Olkin index, 0.67; $p<0.001$). The first factor component was positively loaded on vegetables, seaweed, tofu and deep fried tofu, fishes, and potatoes but negatively loaded on rice and western confectioneries. The first factor component reflected various foods; thus, it was designated as the "traditional Japanese" dietary pattern. The second factor component was positively loaded on noodles, sugar, non-alcoholic beverages, and confectioneries but negatively loaded on rice, green tea, and misosoup. Therefore, the second component was designated as the "noodles and confectioneries" dietary pattern based on the preference for carbohydrate sources. These two factor components accounted for 12.8% and 6.8% of the variance in food intake, respectively (19.6% in total).

Table 2 shows the characteristics of participants stratified by two factor component scores. Those who were living with family member(s) or physically active were more frequently observed in the higher adherence group as compared with the lower adherence group to the "traditional Japanese" dietary pattern. Moreover, men or those with a high education level were more frequently observed in the higher adherence group as compared with the lower adherence group to the "noodles and confectioneries" dietary pattern.

The associations between dietary patterns and ADL, cognitive function, or oral health status determined by multivariable analysis are shown in Table 3. The "traditional Japanese" dietary pattern was significantly inversely associated with dentulous state (OR: 0.53, 95% CI: 0.34–0.82, $p=0.004$) and the lowest tertile of MOF (OR: 0.64, 95% CI: 0.42–0.99, $p=0.046$) but significantly positively associated with denture use (OR: 2.42, 95% CI: 1.26–4.63, $p=0.01$) even after adjusting for potential confounders. In addition, the "noodle and confectioneries" dietary pattern was significantly inversely associated with the lowest tertile of MOF (OR: 0.62, 95% CI: 0.40–0.94, $p=0.03$). The two dietary patterns were not significantly associated with BI or MMSE.

DISCUSSION

To the best of our knowledge, this is the first study to identify two dietary patterns in the community-dwelling very old Japanese population. The first dietary pattern "traditional Japanese" was characterized by the high consumption of vegetables, seaweed, legumes, and fish. The second dietary pattern "noodles and confectioneries" was characterized by the high consumption of noodles, confectioneries, and non-alcoholic beverages. Both patterns were not associated with risks of disability or cognitive decline but were significantly associated with oral health status even after adjusting for potential confounders.

The two dietary patterns identified in the present study agree with previous reports of the dietary patterns found in different generations or areas in Japan. The "traditional Japanese" dietary pattern identified in this study is similar to the "healthy" or "prudent" dietary pattern in terms of the high consumption of vegetables, seaweed, legumes, and fish.[11,30-32] These patterns have also been identified in other countries.[33,34] The present "traditional Japanese" dietary pattern is also similar to the "traditional Japanese" dietary pattern identified in younger Japanese adults.[8,10,35-37]

Table 2. Characteristics of participants stratified by dietary pattern scores

	First factor component "traditional Japanese"			Second factor component "noodles and confectioneries"		
	Low	High	p-value	Low	High	p-value
Number of participants	261	251		264	248	
Age (years)	87.9±2.3	87.7±2.1	0.17	88.1±2.5	87.5±1.9	0.01
BMI (kg/m^2)	21.6±3.2	21.2±3.1	0.22	21.4±3.3	21.5±3.0	0.73
Sex: women (%)	52.1	60.6	0.06	60.6	51.6	0.04
Living arrangement (alone, %)	39.0	27.2	0.01	34.4	32.0	0.57
Education (years)	11.6±3.4	11.1±3.0	0.13	11.0±3.2	11.7±3.3	0.02
Barthel index (<80 points, %)	6.6	6.0	0.86	8.1	4.5	0.10
MMSE (<24 points, %)	18.0	18.1	1.00	21.6	14.3	0.04
Drinking habits (%)			0.87			0.01
Current drinker	34.8	35.7		30.2	40.6	
Former drinker	13.4	11.9		10.9	14.6	
Never been a drinker	51.8	52.5		58.9	44.8	
Current smoker (%)	7.6	6.6	0.73	5.1	9.2	0.08
Physical activity (min/week)	185 (60–395)	210 (90–420)	0.02	210 (63–420)	210 (90–400)	0.51
Comorbidity number (0–7)	2.7±1.4	2.8±1.3	0.55	2.7±1.3	2.8±1.4	0.19
Medical history (%)						
Hypertension	80.3	84.9	0.20	82.2	82.9	0.91
Heart disease	60.2	59.4	0.86	58.9	60.7	0.72
Stroke	24.5	18.3	0.11	19.7	23.4	0.33
Diabetes mellitus	14.2	22.3	0.22	15.5	21.0	0.02
Hyperlipidemia	49.6	55.6	0.18	48.7	56.7	0.08
Renal disease	51.4	48.4	0.54	50.0	49.8	1.00
Dementia	7.3	6.8	0.86	7.2	6.9	1.00

BMI: body mass index; MMSE: mini mental state examination.
Values represent the mean±SD, median (interquartile), or percentage.
Low denotes the low adherence group dichotomized by the median value of the factor score.
High denotes the high adherence group dichotomized by the median value of the factor score.

Table 3. Associations between dietary patterns and health-related outcomes according to the multivariable analysis

		Model 1			Model 2†		
		OR	95% CI	*p*-value	OR	95% CI	*p*-value
Barthel index (total score <80 points)							
"Traditional Japanese" pattern	Low	1.00			1.00		
	High	1.01	(0.53–1.92)	0.99	1.54	(0.69–3.42)	0.29
"Noodles and confectioneries" pattern	Low	1.00					
	High	0.80	(0.41–1.54)	0.50	0.87	(0.39–1.93)	0.72
MMSE (total score < 24 points)							
"Traditional Japanese" pattern	Low	1.00			1.00		
	High	1.14	(0.75–1.73)	0.54	1.11	(0.70–1.77)	0.66
"Noodles and confectioneries" pattern	Low	1.00			1.00		
	High	0.78	(0.51–1.19)	0.25	0.77	(0.49–1.22)	0.27
Dentulous state							
"Traditional Japanese" pattern	Low	1.00			1.00		
	High	0.60	(0.40–0.89)	0.01	0.53	(0.34–0.82)	0.004
"Noodles and confectioneries" pattern	Low	1.00			1.00		
	High	1.50	(1.01–2.23)	0.05	1.48	(0.97–2.26)	0.07
Denture use							
"Traditional Japanese" pattern	Low	1.00			1.00		
	High	2.09	(1.18–3.69)	0.01	2.42	(1.26–4.63)	0.01
"Noodles and confectioneries" pattern	Low	1.00					
	High	0.66	(0.38–1.16)	0.15	0.70	(0.38–1.29)	0.26
Maximum occlusal force (lowest tertile: men <9.8 kg, women <6.7 kg)							
"Traditional Japanese" pattern	Low	1.00			1.00		
	High	0.63	(0.42–0.93)	0.02	0.64	(0.42–0.99)	0.046
"Noodles and confectioneries" pattern	Low	1.00			1.00		
	High	0.59	(0.40–0.88)	0.01	0.62	(0.40–0.94)	0.03

MMSE: Mini-Mental State Examination.
Model 1: Adjusted for age, sex, and body mass index
Model 2: Model 1 + adjustments for drinking habits, smoking habits, living arrangement, education, physical activity level, and comorbidity
†Dementia was excluded from the comorbidity counts in case that MMSE was outcome variable.
Low denotes the low adherence group dichotomized by the median value of the factor score.
High denotes the high adherence group dichotomized by median value of the factor score.

However, the "traditional Japanese" dietary pattern identified in our study differs from that reported in younger populations in terms of its negative loading on rice, which is the most frequently consumed staple food in Japan. In addition to the energy intake, the consumption of rice decreases with age,[38] whereas the consumption of main and side dishes such as vegetables, fishes, and legumes is relatively well maintained. Thus, we assumed that the high consumption of healthy main and side dishes is a common characteristic of the "traditional Japanese" dietary pattern in all generations; however, the consumption of rice may vary depending on the generation.

The "noodles and confectioneries" dietary pattern was very similar to the "noodle" dietary pattern, which was identified by Sugawara et al[30] who characterized three dietary patterns: "Healthy," "Noodle," and "Alcohol and accompaniment," in community-dwelling populations aged >60 years (mean age, approximately 68 years) at Hirosaki city, a rural north-east area of Japan.[30] The "noodle and confectioneries" dietary pattern identified in the present study is similar to the "Noodle" dietary pattern identified by Sugawara et al in terms of its positive loading on noodles and negative loading on rice. However, the positive loading on confectioneries differed from the previous study, where in a negligible loading on confectioneries was reported.[30] The difference between these two studies could be explained by the different characteristics of the participants, including age (mean age, 68 years vs 87 years), motives for home meal preparation, and access to grocery stores.[39] Moreover, among the four basic tastes, only the sweet taste sensitivity remains persistent even in the very old.[40] Thus, we assume that the "noodle and confectioneries" dietary pattern may be a specific food preference of very old individuals who live in metropolitan areas.

We found that oral health status was the most important predictor of dietary patterns in the very old population in the present study. Lee et al previously demonstrated that oral health, food intake, and health-related outcomes were closely related with each other in community-dwelling Taiwanese older population (over 65 years).[41] However, to the best of our knowledge, an association between oral health status and dietary pattern has not been reported previously, and published data are only available for the association between oral health status and single nutrients or foods. The average number of remaining teeth in the very old population was lower than that in younger population.[42] After the loss of teeth, people tend to prefer soft, easily chewable, or low energy density foods,[43] which subsequently leads to decreases in dietary fibre, carotene, micronutrients (e.g., vitamin A and vitamin C), vegetable, and fresh fruit contents, as well as augmenting their consumption of carbohydrate, rice, and confectioneries.[44,45] These previous findings are consistent with the "traditional Japanese" dietary pattern found in the present study. In Japan, white rice is traditionally the most popular staple food, but other staple foods such as noodles and bread are also consumed. Among these staple foods, noodles as compared with white rice are characterized by their smoother texture and requirement of fewer chewing movements.[46] Wearing dentures improves the ability to chew, but it does not contribute to improved food selection habits because these habits are largely dependent on previous dietary patterns or food preferences.[47] Our results suggest that the edentulous state because of age in the very old population may be associated with a preference for a diet that is focused on staple foods and a change in carbohydrate sources from white rice to noodles or confectioneries, whereas remaining in a dentulous state increases the likelihood of continuing to eat vegetables, seaweed, legumes, and fish as main and side dishes, with rice as the carbohydrate source.

We found that disability and cognitive decline were not determinants of dietary patterns in the very old. The "traditional Japanese" dietary pattern is reflected by the consumption of vegetables, fish, fruits, and micronutrients (calcium, β-carotene, vitamins B-6, C, and D, folate, and n-3 polyunsaturated fatty acid; PUFA), and these foods and nutrients will have effects on the prevention of disability or cognitive functional impairment, as reported previously for the "Mediterranean diet" or "healthy eating index."[48-50] The specific reason why these dietary patterns were not associated with ADL or cognitive function was not clarified in the present study. However, the characteristics of our participants differed in terms of their mean age, culture, ethics, prevalence of disability or cognitive-related diseases (e.g., diabetes mellitus), and physical activity compared with those in previous studies.[48-50] Thus, we assumed that the discrepancy between previous studies and the present study may be attributable to differences in the characteristics of the participants.

Several limitations of the present study should be mentioned. First, the dietary data were obtained using self-administered BDHQ. The validity and reliability of this dietary questionnaire was evaluated in women and men aged 31–76 years and living in urban and rural areas,[51] but it has not been fully evaluated in very old populations. As aforementioned, the participants were not always involved in food acquisition or preparation, and some of them were not familiar with the accurate names of foods;[15] therefore, the potential misclassification of dietary patterns may have affected our results. Second, we evaluated the cognitive functions of participants using MMSE, but the MMSE scores do not exactly reflect cognitive functions. Therefore, further studies are needed to investigate the relationship between dietary patterns and other cognitive function parameters. Finally, the present study was cross sectional; therefore, the causal links between dietary patterns and health-related outcomes, including oral health status, were not clarified.

Conclusion

In this study, we identified two dietary patterns in the community-dwelling very old population in Japan, which were closely related to oral functions rather than any other health-related outcomes, including ADL and cognitive function. Thus, the maintenance of oral function should be essential, and approaches such as individualized counseling based on oral health status or texture modification food services are needed to configure dietary interventions in the community-dwelling very old population.

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AUTHOR DISCLOSURES

All other authors have nothing to disclose.

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Supplemental table 1. Nutrient and food intake of participants stratified by dietary pattern scores

	First factor component ("traditional Japanese")			Second factor component ("noodles and confectioneries")		
	Low (n=261)	High (n=251)	*p*-value	Low (n=264)	High (n=248)	*p*-value
EI (kcal/day)	1893±561	1985±585	0.07	1775±526	2112±574	<0.001
Nutrient intake						
Protein (% EI)	14.5±2.6	17.3±3	<0.001	15.9±3.4	15.8±2.9	0.68
Animal protein (% EI)	8.1±2.9	10.7±3.4	<0.001	9.4±3.6	9.4±3.1	0.98
Plant protein (% EI)	16±2.5	16.5±2.2	0.01	6.6±1	9.4±3.1	0.14
Carbohydrate (% EI)	55.3±7.2	49.7±6.3	<0.001	53.2±7.9	51.8±6.6	0.03
Fat (%EI)	12.2±2.3	14±2	<0.001	12.8±2.6	13.3±2.0	0.004
Retinol (μg/1000 kcal)	245±317	292±244	0.06	257±321	279±240	0.39
Calcium (mg/1000 kcal)	420±270	399±229	0.36	448±269	370±225	<0.001
β-carotene (μg/1000 kcal)	1860±1006	3223±1305	<0.001	2659±1577	2389±1031	0.02
Vitamin C (g/1000 kcal)	74.7±28.2	104±28.3	<0.001	91.2±35.1	87.1±28.0	0.14
Vitamin D (μg/1000 kcal)	7.5±4.7	12±6.3	<0.001	9.9±6.7	9.5±5.1	0.42
Vitamin B_6 (mg/1000 kcal)	0.6±0.1	0.9±0.1	<0.001	0.8±0.2	0.7±0.1	0.06
Folate (μg/1000 kcal)	190±57	267±55	<0.001	236±77	219±56.0	0.004
n-3 PUFA (mg/1000 kcal)	1.5±0.4	2.1±0.4	<0.001	1.8±0.6	1.8±0.5	0.67
Total dietary fiber (g/1000 kcal)	6.5±1.5	8.9±1.8	<0.001	7.8±2.3	7.5±1.7	0.18
Food intake (g/1000 kcal)						
Rice	130±68	104±54	<0.001	144±67	90±44	<0.001
Noodles	32.8±28.9	35.5±26.9	0.26	23.7±20.9	44.5±30.2	<0.001
Breads	27.8±18.1	21.9±15.4	<0.001	23.9±18.9	25.8±14.8	0.20
Potatoes	25.6±22.1	38±23.4	<0.001	35.3±26.1	27.9±20.0	<0.001
Sugar and sweeteners	3.2±2.6	3.2±1.9	0.91	2.7±1.7	3.7±2.6	<0.001
Legumes	28.2±24.7	41.9±18.9	<0.001	38.4±26.6	31.3±18.0	<0.001
Green and yellow vegetables	47.4±29.8	83.6±34.9	<0.001	66.6±41.7	63.5±31.5	0.34
Other vegetables	71.4±34	135±46.1	<0.001	108±59.3	96.6±40.7	<0.001
Fruit	73.5±55	87.3±52	0.004	78.7±57.4	81.9±50.1	0.51
Fish and shellfish	40.3±23.5	65.7±30.4	<0.001	52.3±32.3	53.3±27.2	0.7
Meat	30.4±19.3	33.6±17.6	0.05	31.1±19.4	32.9±17.6	0.28
Eggs	19±15.9	19.9±11.8	0.5	21±16	17.9±11.2	0.01
Milk products	89.8±61.9	84.4±51.6	0.28	91.3±59.7	82.7±53.9	0.09
Oils	9.8±3.7	14.3±3.7	<0.001	11.8±4.8	12.3±3.8	0.16
Confectioneries	46.7±27.0	29.7±18.5	<0.001	32.7±23.8	44.4±24.3	<0.001
Beverages	404±189	383±167	0.18	376±178	412±179	0.02
Spice and seasoning	3.1±0.8	3.7±0.8	<0.001	3.4±0.8	3.4±0.9	0.68

EI: energy intake; PUFA: polyunsaturated fatty acid.
All values represent the mean±SD.
Low denotes the low adherence group dichotomized by the median value of the factor score. High denotes the high adherence group dichotomized by the median value of the factor score.