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Eating Frequency of Rice vs. Bread at Breakfast and Nutrient and Food-Group Intake among Japanese Female College Students

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ABSTRACT

We examined the association between eating frequency of rice vs. bread at breakfast and nutrient and food-group intake among 1771 female college students aged 18 – 20 years. The frequency of main staples at breakfast and the nutrient and food group intake for the previous month were assessed with a validated self-administered diet history questionnaire. We divided main staples into rice, bread, and noodles. As the eating frequency for noodles was almost negligible, we computed the difference of eating frequency of rice minus that of bread (mean = 0.7 times/week). Among 16 nutrients examined, the difference of eating frequency correlated significantly and negatively only with fat intake, especially saturated fatty acid (SFA) ($r = -0.31$, $p < 0.001$), and significantly and positively with the intake of n-3 polyunsaturated fatty acid, iron, sodium, protein, carotene, potassium, dietary fiber, and vitamin C ($r = 0.08 - 0.15$, $p < 0.001$) after adjusting for the energy intake, the residential area, the population size, and the living status with their families. In conclusion, the more frequent intake of rice compared to bread at breakfast correlated with the higher intake of the several vitamins and minerals, and the lower intake of fat, especially SFA. The only unfavorable aspect of the rice group was the higher sodium intake. (*J Community Nutrition* 4(2) : 83~89, 2002)

KEY WORDS : breakfast · rice · bread · nutrient intake · Japanese adolescents.

Introduction

The westernization of the diet has spread in Japan during the past 50 years, characterized mainly by the increase in fat intake and decrease in carbohydrate intake (Yoshiike et al. 1996). However, since the mean fat intake of the Japanese exceeded the upper limit of the recommended dietary allowance (25% of total energy) in 1988 (Yoshiike et al. 1996), the excessive Westernization of the diet has become a public concern. Today, favorable aspects of the traditional Japanese dietary pattern are being reassessed.

Oriental diets, in which the Japanese diet is included, are characterized by eating rice at meals, especially at breakfast. Therefore, the main staple at breakfast can roughly differentiate the eating pattern, either traditional Japanese or Western. Some previous studies examined the constitution of food consumption and found internal relationships among food consumption (Toyokawa 1978). In one study, 19 food groups were classified into two groups, i.e., a group consisting of rice, pulses, miso (fermented soybean paste), salted vegetables, and seaweed, and a group consisting of breads, fats and oils, meats and poultry, eggs, fruits, and beverages (Akabane et al. 1977). In these studies, rice and bread were key foods for characterizing the constitution of food consumption. Also, dichotomous differentiation of diets by rice vs. bread at breakfast has been used in some epidemiological studies

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as an indicator of Westernization of diets (Kato et al. 1990). However, studies reporting correlation between rice- vs. bread-eating behaviors and nutrient and food group intakes have been scarce (Nagata et al. 1999).

Moreover, the westernization of the diet has progressed further among children and adolescents than the older counterparts (Ministry of Health and Welfare 1999a, Sasaki, Tsuji 2000).

We therefore examined the correlation between the eating frequency of rice vs. bread at breakfast and nutrient and food group intakes among adolescents, i.e., 1771 female college students aged 18 − 20 years.

Subjects and Methods

1. Subjects and survey schedule

The subjects of our study were students who entered dietetic courses of 22 colleges and technical schools in 13 prefectures in Japan in April 1997 (n = 2069). The names of 22 colleges and technical schools have been described elsewhere (Sasaki et al. 2000a). The survey was conducted between 7th and 21st of April 1997. The 2063 students (2017 women and 46 men) responded to the survey (response rate = 99.7%). The local staff of each school checked the submitted questionnaires. When missing and/or logical errors were found, the staff asked the subjects to answer the questions again. The questionnaires were checked at least once by the local staff and once by the staff of our study center (AK and SS). Most of the surveys were completed before the end of May.

2. Questionnaires

We used two questionnaires : a self-administered diet history questionnaire (DHQ) (Sasaki et al. 1998a ; Sasaki et al. 1998b ; Sasaki et al. 2000b) and a questionnaire for general life-style.

The former was a validated 16-page questionnaire on one-month dietary habits. Questions about eating frequency of main staples, i.e., rice, bread, and noodles at breakfast were included in DHQ. The DHQ has been validated using three different gold standards as follows. Firstly, we compared nutrient intakes assessed by DHQ with those assessed by 3-day dietary record among** middle-aged women. Pearson correlation coefficients ranged from 0.33 to 0.75 (mean was 0.4*) in 13 energy-adjusted nutrients (Sasaki et al. 1998a). Also, the mean intakes assessed by the two methods were similar (difference was 0 − 10% in three macronutrients and 0 − 23% in** micronutrients) (Sasaki et al. 1998a). Secondly we compared sodium and potassium intakes assessed by DHQ with those of 24-hour urinary excretions among*** female university students. Although Pearson correlation for sodium was not significant ($r = 0.20$), that for potassium was significantly positive ($r = 0.40$) (Sasaki et al. 1998b). Thirdly, we compared marine-origin n-3 polyunsaturated fatty acid (PUFA) and carotene intakes assessed by DHQ with those of serum concentrations, which have often been used as reliable biomarkers, among** middle-aged men and women. A significantly positive correlation was observed in both nutrients ($r = 0.^{**}$ and $0.^{**}$ respectively, $p < 0.001$ for both) (Sasaki et al. 2000b). From these results, we have concluded DHQ as reliable enough, although validity for the present population was not directly examined.

The latter was a 4-page questionnaire designed for this survey. It asked about general life-style factors including residential (city/town/village) and living status. The residential area was specified as a place where the subject mainly lived during the previous month.

3. Statistical analysis

Among the 2017 women who completed the questionnaire, we selected 1771 women (88% of the women who completed the questionnaire) according to the following criteria :

1) Subjects aged 18 − 20 years on the surveyed day

2) Subjects with information on the residential area and living status

3) Subjects whose reported energy intake was more than or equal to a half of the energy requirement of the lowest physical activity category (1500kcal/day) and less than 1.5 times the energy requirement of the highest physical activity category (2300kcal/day) (Ministry of Health and Welfare 1999b)

4) Subjects whose sum of frequency of main staples, i.e., rice, bread, and noodles, at breakfast was less than or equal to 7 times/week

5) Subjects whose main residential environment was in Japan

The intakes of 16 nutrients and 14 food-groups were computed using an ad-hoc algorithm and were used in the present study. Polyunsaturated fatty acid to saturated fatty acid (SFA) ratio (P/S ratio) and n-6 PUFA to n-3 PUFA ratio (n-6/n-3 ratio) were included in the analyses. The 147 foods calculated from DHQ were grouped into 17 food groups, mainly, according to the food composition tables of Japanese foods, 4th revised edition. The categorization method has been described elsewhere (Sasaki & Tsuji 2000). In this study, because the mean intakes were much lower than other food groups, sweeteners, nuts, and mushrooms and sea vegetables were included into confectioneries, pulses, and non-green and yellow vegetables, respectively.

The residential areas were categorized into 12 blocks according to the National Nutrition Survey of Japan (Ministry of Health and Welfare 1999). Because the subjects categorized into 3 of these blocks were relatively few, they were included in their neighboring regions. The residential towns were also categorized into 3 groups according to population size, i.e., cities with population of more than one million, those of less than one million, and towns and villages. Living status was categorized into 3 groups, i.e., living with family, alone, and others.

The relative frequency of eating rice compared to that of bread was computed as the difference between the two, i.e., the frequency of eating rice minus that of bread (times/week). This value will be referred to as "rice vs. bread frequency difference" hereafter.

Firstly, the mean frequency of breads at breakfast was calculated by residential area, the size of residential area, and living status. The effect of these 3 residential factors was examined by a one-way analysis of variance (ANOVA). The effects were also examined by adjusting for the other two residential factors.

Secondly, the mean nutrient and food-group intakes were calculated by quintile of the rice vs. bread frequency differences. Energy-adjusted values by residual method were used for the calculation (Willett & Stampfer 1986). Energy-density values were also included in the analysis for macronutrients. The effect of the frequency was examined by ANOVA, adjusting for residential region, size of residential area, and living status. Spearman correlation coefficients were also calculated adjusting for the same factors. The analyses were also done for body height, body weight, and body mass index (BMI). Because they were not statistically different among rice vs. bread frequency differences, the results are not presented here.

All analyses were done using SAS statistic software, version 6.12 (SAS Institute Inc., Cary NC, USA). Less than 5% error is considered as statistically significant.

Results

The mean (standard deviation (SD)) age, body height, body weight, and BMI were 18.1 (0.4) years, 157.9 (5.2) cm, 51.8 (7.0) kg, 20.8 (2.6) kg/m^2, respectively. They were not statistically different by rice vs. bread frequency differences.

Eating frequencies of rice, bread, and noodles at breakfast are shown in Table 1. The mean frequency of rice and bread was 3.4 and 2.7 times/week respectively. 96%, of the subjects had no noodles at breakfast. 1169 subjects (66% of the subjects) had breakfast every morning, and 33 (2% of

Table 1. Number (percentage) of subjects by main staple at breakfast (n = 1771)

Frequency of breakfast	Rice	Bread	Noodle	Any
(times/week)	n (%)	n (%)	n (%)	n (%)
0	413 (23)	449 (25)	1697 (96)	33 (2)
1	145 (8)	305 (17)	54 (3)	20 (1)
2	152 (9)	246 (14)	13 (1)	34 (2)
3	181 (10)	154 (9)	5 (0)	48 (3)
4	158 (9)	129 (7)	1 (0)	78 (4)
5	246 (14)	135 (8)	1 (0)	180 (10)
6	218 (12)	112 (6)	0 (0)	209 (12)
7	258 (15)	241 (14)	0 (0)	1169 (66)

SD : standard deviation.

Table 2. Frequency of rice at breakfast minus that of bread by residential block, size of residential area (city/town/village), and living status

	N	Mean ± SD
Kanto II, Tohoku, Hokkaido	82	1.9 ± 4.1
Kanto I	406	0.3 ± 4.7
Tokai, Hokuriku	262	0.6 ± 4.7
Kinki I	147	−0.6 ± 4.9
Kinki II	100	−0.8 ± 4.9
Chugoku	272	0.6 ± 5.0
Shikoku	141	0.6 ± 4.6
Kita-kyushu	195	1.6 ± 4.7
Minami-kyushu	166	1.9 ± 4.3
City with population > 1 million	306	−0.1 ± 4.7
City with population < 1 million	1018	0.6 ± 4.8
Town and village	447	1.3 ± 4.7
Living with families	1558	0.6 ± 4.8
Living alone	149	0.2 ± 4.6
Other	64	2.2 ± 4.4
	1771	0.7 ± 4.8

[1]One-way analysis of variance.
[2]Analysis of variance adjusted for other variables listed in the table. SD : standard deviation.

total subjects) had no breakfast.

Table 2 shows the mean (SD) rice vs. bread differences by residential region, size of city/town/village, and living status. The rice vs. bread difference were significantly different among all 3 factors.

Table 3 shows mean energy and nutrient intakes by quintiles of rice vs. bread frequency differences. Energy intake was slightly and negatively correlated with rice vs. bread frequency differences ($r = -0.05$, $p < 0.05$). The mean intakes of saturated fatty acid (SFA) and monounsaturated fatty acid (MUFA) steadily decreased according to the increase in rice vs. bread frequency differences. A significantly negative correlation was observed for SFA, MUFA, n-6/n-3 ratio, and total fat ($r = -0.31 - -0.16$, $p < 0.001$). In contrast, P/S ratio, the mean intakes of carbohydrate and carotene, steadily increased according to the increase in rice vs. bread frequency differences. A significantly positive correlation was observed for P/S ratio, sodium, n-3 PUFA, carbohydrate, carotene, vitamin C, iron, protein, and potassium ($r = 0.08 - 0.23$, $p < 0.001$).

Table 4 shows the mean food group intakes by quintiles of rice vs. bread frequency differences. A significantly negative correlation was observed for confectioneries and dairy products ($r = -0.34 - -0.10$, $p < 0.001$). A significantly positive correlation was observed for cereals, soup, pulses, fish, non-green and yellow vegetables, seasonings, green and yellow vegetables, and meats ($r = 0.09 - 0.43$, $p < 0.001$).

Discussion

We observed a clear difference of nutrient and food-group intakes by rice vs. bread frequency differences. The dietary pattern in the group with higher frequency of rice at breakfast was relatively close to the "prudent dietary pattern" defined by the factor analysis of the American diet, such as negative correlation with fat, especially SFA, and positive correlation with carotene and potassium (Hu et al. 1999). The only unfavorable aspect in the rice group was the higher intake of sodium. Although highly significant because of a large number of subjects, low correlation coefficients with breakfast type for some nutrients such as vitamin C, dietary fiber, and potassium ($r = 0.08 - 0.11$) are probably not practically important.

In this study, we used a self-administered semiquantitative dietary assessment questionnaire (Sasaki et al. 1998a, Sasaki et al. 1998b, Sasaki et al. 2000b). Since it did not observe actual dietary habits, the results should be cautiously interpreted. In order to avoid possible inaccuracy as much as possible, we used the validated questionnaire with reasonable validity as previously described. Moreover, to obtain a reliable eating frequency of main staples, a certain number of days, e.g., at least one week, were needed. Therefore we used the questionnaire that examined one-month dietary habits.

We did not consider the eating frequency of noodles at breakfast. It might have obscured the results. However, 96% of the subjects had no noodles at breakfast, and 99% of the subjects had breakfast with noodles once per week or less. Therefore the exclusion of eating frequency of noodles from the analysis was not thought to have seriously distorted the results. We did the same analyses using the data of the subjects with no noodles at breakfast ($n = 1697$), and the results have not materially changed (data not shown).

In this analysis, the 33 subjects without breakfast were included in the category for the subjects with equal eating frequency for rice and bread at breakfast. However, the dietary habits may be different from each other. We did the same analyses excluding these 33 subjects ($n = 1738$), and the change in the results has been negligible (data not shown). We also did the same analyses using only the subjects who did not skip breakfast ($n = 1131$). Again, the results were almost the same (data not shown).

One previous study examined nutrient intakes by type of breakfast, i.e., Western (bread) and Japanese (rice) types, and failed to observe any statistical difference except crude fiber among 18 nutrients examined between the two groups (Nagata et al. 1999). Several reasons were postulated for the discrepancy of the results. First, the present study asked frequency of rice and bread at breakfast by times per week, whereas the previous study dichotomously asked the dominant type, i.e., breakfast with rice or with bread. Secondly, the questionnaire used in the present study was more comprehensive and complicated to capture dietary habits with higher validity than that used in the large-scale epidemiological study where a high level of feasibility was required (Shimizu et al. 1999). Thirdly, the age-range was higher, 35 years and over, in the previous study, whereas the present study examined young females with a wider variety for breakfast type.

In the previous studies, bread intake positively correlated with intakes of meats and poultry, and fruits (Akabane et al.

Table 3. Daily intakes of energy and nutrients (mean ± SD) by frequency of rice at breakfast minus that of bread, and their correlates[1]

	Quintile by frequency of rice at breakfast minus that of bread (times/week)						ANOVA[2]		Spearman correlation coefficient[2]	
	Lowest (n = 403)	Second lowest (n = 288)	Middle (n = 296)	Second highest (n = 478)	Highest (n = 306)	Total (n = 1771)				
Range	(−7, −5)	(−4, −1)	(0, 2)	(3, 5)	(6, 7)	(−7, 7)				
Mean ± SD	−6.3 ± 0.9	−2.1 ± 1.1	0.9 ± 0.7	4.1 ± 0.9	6.8 ± 0.4	0.7 ± 4.8	F-value	p-value	r	p-value
Frequency of main staple at meals										
Rice (times/week)	0.2 ± 0.4	1.8 ± 1.0	2.7 ± 1.3	5.2 ± 0.7	6.8 ± 0.4	3.4 ± 2.5	–	–	–	–
Bread (times/week)	6.5 ± 0.7	3.9 ± 1.1	1.8 ± 1.1	1.1 ± 0.7	0.0 ± 0.0	2.7 ± 2.5	–	–	–	–
Energy intake (kcal)	1837 ± 468	1794 ± 476	1734 ± 496	1746 ± 460	1770 ± 490	1777 ± 477	2.87	0.022	−0.05	0.024
Nutrient intake (energy-adjusted value by residual method)[3]										
SFA (g)	20.6 ± 3.8	19.7 ± 4.0	19.4 ± 3.5	18.0 ± 3.3	17.7 ± 3.7	19.1 ± 3.8	39.95	<0.001	−0.31	<0.001
n-6/n-3 ratio	5.2 ± 1.3	5.0 ± 1.2	4.9 ± 1.3	4.7 ± 1.0	4.6 ± 1.1	4.9 ± 1.2	17.78	<0.001	−0.21	<0.001
MUFA (g)	22.9 ± 4.6	21.9 ± 4.5	22.7 ± 4.5	21.2 ± 4.1	21.0 ± 4.7	21.9 ± 4.5	13.18	<0.001	−0.19	<0.001
Total fat (g)	63.6 ± 10.8	61.4 ± 11.2	63.2 ± 10.5	59.9 ± 10.0	59.9 ± 10.9	61.5 ± 10.7	10.84	<0.001	−0.16	<0.001
n-6 PUFA (g)	12.3 ± 3.5	12.0 ± 3.0	12.6 ± 3.2	12.1 ± 2.9	12.2 ± 3.1	12.2 ± 3.2	1.91	0.106	−0.02	0.445
Cholesterol (mg)	300.4 ± 116.5	297.9 ± 116.2	296.4 ± 104.6	304.1 ± 103.9	313.9 ± 143.3	302.6 ± 116.5	1.05	0.382	0.02	0.516
PUFA (g)	14.6 ± 4.4	14.3 ± 3.7	15.2 ± 4.0	14.7 ± 3.5	15.0 ± 3.8	14.8 ± 3.9	2.23	0.064	0.03	0.247
Calcium (mg)	539.1 ± 186.5	557.0 ± 205.3	549.0 ± 200.2	550.2 ± 195.0	566.6 ± 213.8	551.4 ± 199.0	0.56	0.693	0.03	0.200
Carbohydrate (g)	233.8 ± 27.6	236.4 ± 28.6	232.8 ± 25.8	238.2 ± 27.3	237.2 ± 29.8	235.8 ± 27.9	2.76	0.026	0.07	0.003
Vitamin C (mg)	103.5 ± 50.6	108.6 ± 57.1	114.5 ± 57.6	114.6 ± 50.0	115.5 ± 55.5	111.2 ± 53.8	3.04	0.017	0.08	<0.001
Dietary fiber (g)	11.2 ± 3.1	11.7 ± 3.8	11.6 ± 3.6	12.1 ± 3.4	12.3 ± 4.4	11.8 ± 3.6	4.08	0.003	0.09	<0.001
Potassium (mg)	1995 ± 523	2066 ± 536	11.6 ± 557	2142 ± 534	2182 ± 596	2094 ± 550	5.56	<0.001	0.11	<0.001
Carotene (μg)	1844 ± 1245	1958 ± 1398	2006 ± 1488	2136 ± 1338	2349 ± 1454	2056 ± 1383	6.17	<0.001	0.14	<0.001
Sodium (mg)	3272 ± 891	3399 ± 878	3608 ± 1035	3662 ± 1042	3674 ± 1146	3524 ± 1015	10.82	<0.001	0.14	<0.001
Protein (g)	61.8 ± 11.2	63.2 ± 10.5	63.3 ± 10.2	65.2 ± 10.9	66.6 ± 12.2	64.0 ± 11.1	9.67	<0.001	0.14	<0.001
Iron (mg)	7.8 ± 1.8	8.1 ± 2.0	8.2 ± 1.9	8.4 ± 1.8	8.7 ± 2.2	8.2 ± 2.0	8.86	<0.001	0.15	<0.001
n-3 PUFA (g)	2.5 ± 1.0	2.5 ± 0.8	2.7 ± 1.0	2.7 ± 0.9	2.8 ± 0.9	2.7 ± 0.9	9.73	<0.001	0.15	<0.001
P/S ratio	0.73 ± 0.21	0.75 ± 0.20	0.80 ± 0.23	0.84 ± 0.22	0.87 ± 0.23	0.80 ± 0.22	22.62	<0.001	0.23	<0.001
Nutrient intake (energy-density value)[3]										
Total fat (%E)	31.9 ± 5.5	30.7 ± 5.4	30.9 ± 5.9	29.4 ± 5.7	29.2 ± 6.7	30.4 ± 5.9	15.30	<0.001	−0.17	<0.001
Carbohydrate (%E)	52.9 ± 6.1	53.6 ± 6.3	53.5 ± 6.6	54.7 ± 6.8	54.7 ± 8.0	53.9 ± 6.8	5.37	<0.001	0.10	<0.001
Protein (%E)	13.9 ± 2.2	14.2 ± 2.2	14.2 ± 2.3	14.6 ± 2.3	14.8 ± 2.7	14.3 ± 2.4	7.87	<0.001	0.13	<0.001

[1]Energy-adjusted values by residual method were used for analysis. [2]Adjusted for residential block, size of residential area (city/town/village), and living status.
[3]The values were listed by ascending order of the Spearman correlation coefficients.
SD : standard deviation, SFA : saturated fatty acids, MUFA : monounsaturated fatty acids, PUFA : polyunsaturated fatty acids, P/S ratio : PUFA to SFA ratio, n6/n3 ratio : n-6 PUFA to n-3 PUFA ratio, %E : percentage of total energy including ethanol.

Table 4. Daily intakes(g) of food groups(mean ± SD) by frequency of rice at breakfast minus that of bread, and their correlates[1,2]

	Quintile by frequency of rice at breakfast minus that of bread (times/week)								Spearman correlation coefficient[3]	
	Lowest (n = 400)	Second lowest (n = 286)	Middle (n = 276)	Second highest (n = 483)	Highest (n = 326)	Total (n = 1771)	ANOVA[3]			
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	F-value	p-value	r	p-value
Confectioneries[4]	90.4 ± 42.9	85.4 ± 41.0	77.5 ± 36.7	63.8 ± 28.9	57.3 ± 29.6	74.5 ± 38.1	51.04	<0.001	−0.34	<0.001
Dairy products	163.2 ± 115.9	161.9 ± 126.1	153.8 ± 120.3	145.9 ± 119.9	142.4 ± 127.2	153.2 ± 121.6	2.53	0.039	−0.10	<0.001
Fats and oils	22.2 ± 16.7	20.6 ± 12.1	23.4 ± 15.0	21.1 ± 12.9	20.5 ± 13.1	21.5 ± 14.1	2.46	0.044	−0.07	0.004
Eggs	31.6 ± 22.9	29.8 ± 21.4	28.7 ± 19.4	30.4 ± 19.7	32.1 ± 28.5	30.6 ± 22.4	1.20	0.309	−0.01	0.693
Beverages	765.1 ± 499.7	789.6 ± 452.0	755.2 ± 463.3	798.7 ± 476.4	729.9 ± 494.8	770.4 ± 479.1	1.06	0.376	−0.01	0.781
Fruits	98.6 ± 119.1	110.4 ± 116.0	115.8 ± 103.9	109.2 ± 93.2	104.1 ± 109.5	107.2 ± 107.9	1.06	0.372	0.03	0.246
Potatoes	30.6 ± 19.6	30.1 ± 18.4	32.8 ± 16.8	36.0 ± 25.0	33.7 ± 22.1	32.9 ± 1.1	5.26	<0.001	0.07	0.006
Meats	62.5 ± 32.8	62.5 ± 30.9	67.6 ± 30.0	68.2 ± 30.2	70.3 ± 33.9	66.2 ± 31.7	4.94	<0.001	0.09	<0.001
Green and yellow vegetables	68.2 ± 47.4	73.0 ± 53.8	71.9 ± 50.5	77.7 ± 50.5	83.8 ± 56.3	74.9 ± 51.6	4.07	0.003	0.11	<0.001
Seasonings	10.2 ± 5.9	11.3 ± 5.7	12.2 ± 7.8	11.9 ± 6.0	12.2 ± 7.9	11.5 ± 6.7	4.67	<0.001	0.11	<0.001
Non-green and yellow vegetables[5]	122.5 ± 70.5	130.5 ± 73.1	140.0 ± 92.6	145.9 ± 70.6	150.9 ± 84.8	138.0 ± 78.2	6.84	<0.001	0.14	<0.001
Fish	56.5 ± 35.1	63.7 ± 33.8	66.0 ± 34.7	71.8 ± 39.8	75.1 ± 40.1	66.6 ± 37.6	14.62	<0.001	0.17	<0.001
Pulses[6]	38.4 ± 27.1	43.8 ± 28.4	45.1 ± 27.9	53.0 ± 31.7	60.8 ± 39.3	48.2 ± 32.0	23.93	<0.001	0.23	<0.001
Soups mainly miso-soup	88.9 ± 65.3	108.3 ± 77.7	135.5 ± 95.3	157.2 ± 93.1	163.5 ± 95.8	131.2 ± 90.8	46.10	<0.001	0.33	<0.001
Cereals	343.0 ± 73.2	355.6 ± 91.6	364.7 ± 83.5	417.8 ± 83.8	438.5 ± 97.9	385.4 ± 93.2	84.32	<0.001	0.43	<0.001

[1]Energy-adjusted values by residual method were used for analysis.
[2]The values were listed by ascending order of the Spearman correlation coefficients.
[3]Adjusted for residential block, size of residential area (city/town/village), and living status.
[4]Including sweeteners.
[5]Including mushrooms and sea vegetables.
[6]Including nuts.
SD : standard deviation.

1977). However, in the present study, the higher frequency of rice, i.e., the lower frequency of breads, correlated with the higher intakes of meats and fruits (Table 4). Because a 23-year interval exists between the two surveys, the constitution of food consumption may have changed during this period. One study suggested this possible change by an analysis using two dietary data collected in 10-year intervals (Nishikawa, Toyokawa 1999). Moreover, the present study used the frequency of rice minus bread intake and the effects of residential factors were adjusted for by multivariate analysis. In contrast, the previous studies have more simply examined the correlation between food intakes. The comparison of the results may therefore be difficult.

Conclusion

The type of main staple at breakfast, simply rice vs. bread, could differentiate individuals into two types of dietary habits, i.e., traditional Japanese or Western types. Also, a simple suggestion to increase frequency of rice compared to that of breads may partly help to decrease the intake of SFA and MUFA and to increase the intake of nutrients, that may help to prevent cardiovascular disease and cancer, such as n-3 PUFA and carotene, although continuous caution is necessary for more reduction of sodium intake. Further studies are needed to examine whether or not similar results are observed in other Japanese and East Asian populations where rice has been the main staple and Westernization of the diet has occurred.

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