Rice Consumption with Type 2 Diabetes in Japanese Men and Women: A Prospective Study from the Japan Public Health Centre

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Abstract

Background: Refined carbohydrates have been suggested to deteriorate glucose metabolism; however, whether persons with elevated intakes of white rice, which is a major staple food for the Japanese, experience increased risk of developing type 2 diabetes remains unclear.

Objective: We prospectively investigated the association between white rice intake and risk of type 2 diabetes.

Design: Participants were 25,666 men and 33,622 women aged 45–75 y who participated in the second survey of the Japan Public Health Center–based Prospective Study and who had no prior history of diabetes. We ascertained food intake by using a validated 147-item food-frequency questionnaire. Odds ratios of self-reported, physician-diagnosed type 2 diabetes over 5 y were estimated by using logistic regressions.

Results: A total of 1103 new cases of type 2 diabetes were self-reported. There was a significant association between rice intake and an increased risk of type 2 diabetes in women; the multivariate-adjusted odds ratio for the highest compared with lowest quartiles of rice intake was 1.65 (95% CI: 1.06, 2.57; P for trend = 0.005). In men, the association was unclear, although there was a suggestion of a positive association in persons who were not engaged in strenuous physical activity (P for trend = 0.08).

Conclusions: Elevated intake of white rice is associated with an increased risk of type 2 diabetes in Japanese women. The finding that is suggestive of a positive association of rice intake in physically inactive men deserves further investigation.

Keywords: Type 2 diabetes; Carbohydrates; Rice consumption; Japan public health centre; White rice

Subjects and Methods

Study population

The Japan Public Health Center–based Prospective (JPHC) Study included residents of 11 public health centers between the ages of 40 and 69 at each baseline survey. It was launched in 1990 for cohort I and 1993 for cohort II [1]. Participants in the study were made aware of the study's goals, and those who completed the questionnaire were considered to have consented to participate. At both the five- and ten-year follow-ups, a questionnaire survey was administered. At each survey, data on medical histories and health-related lifestyles like smoking, drinking, and eating habits were gathered. This study was endorsed by the Institutional Audit Leading group of the Public Disease Focus of Japan [2].

Due to differences in recruitment criteria, we excluded subjects who resided in two public health center areas from the baseline study population (n = 140,420). 95,373 (81.7%) of the remaining 116,672 eligible subjects completed the baseline questionnaire survey. 80,128 (84.0 percent) of these subjects completed the diet-related 5-year follow-up survey (second survey) and 71,075 (74.5 percent) completed the subsequent 10-year follow-up survey (third survey) [3]. At the baseline or second surveys, we excluded any subject who had a history of type 2 diabetes (n = 5183) or severe diseases (n = 6284), such as cancer, cerebrovascular disease, myocardial infarction, chronic liver disease, or renal disease. 556 extra subjects with missing data for rice consumption and 537 subjects who detailed outrageous complete energy admissions (beyond the mean ± 3 SD as per sex) were rejected, which left a sum of 59,288 subjects (25,666 men and 33,622 ladies) who were at last signed up for our investigation [4].

Food-frequency questionnaire

Participants completed a self-administered questionnaire at the baseline, second, and third surveys [5]. During information examinations in the ongoing review, we involved information from the second overview as benchmark information on the grounds that the poll utilized for the subsequent study more thoroughly asked about food admissions than that utilized for the standard study. A food-frequency questionnaire (FFQ) was used in the second survey to determine the average amount of 147 food and beverage items consumed over the previous year [6]. Regarding rice (japonica rice; round and short grain), members were approached to signify their typical rice-bowl size from 3 choices (little, medium, and enormous) and the quantity of bowls consumed everyday from 9 choices that went from <1 to ≥10/d. One bread thing and 4 noodle things (Japanese, buckwheat, Okinawa, and Chinese noodles) were likewise remembered for the FFQ. For most food things, including the bread and noodle things, 9 reaction choices were accessible to portray utilization recurrence, which went from once in a while (<1 time/mo) to ≥7 times/d. Each food had a standard serving size, and respondents were asked to select one of three options: standard, less than one-half, or more than 1.5 times their usual serving size. We multiplied the typical portion size by the daily consumption frequency to determine the daily intake of staple foods [7].

Ascertainment of type 2 diabetes

At the third survey, a self-administered questionnaire was used to determine whether or not the respondent had type 2 diabetes. The respondent had been diagnosed with type 2 diabetes within the preceding five years. At the third review, concentrate on members were inquired as to whether they had at any point been determined to have diabetes, and provided that this is true, when the underlying analysis had been made [8]. Only subjects who were diagnosed after 1995 for cohort I and after 1998 for cohort II were considered incident cases during follow-up because we used the second survey as the starting point for observing the incidence of type 2 diabetes. Insights about the evaluation of the legitimacy of self-announced diabetes have been portrayed somewhere else [9].

Physical activity

The average amount of time spent each day engaging in three types of physical activity—at work and in their leisure time—was used as a measure of daily physical activity. non-strenuous physical activity (none, 1, or 1), sitting (3, 3 to 8, or 8), and standing or walking (1, 1 to 3, or 3) for 1 or 1 hours. Insights about the estimation of absolute active work level (metabolic comparable

undertaking hours [MET-h]/d) have been portrayed somewhere else (20). Using 4-day, 24-hour physical activity records from two distinct seasons, the validity of the total METs per day was evaluated in subsamples. Men's and women's Spearman correlation coefficients for daily total METs and physical activity records were 0.53 and 0.35, respectively [10].

Results

During the 5-year period, 1103 participants (including 625 men and 478 women) received a new diabetes diagnosis. Table 1 displays the characteristics of men and women participating in the study according to quartile categories of rice, bread, and noodle consumption. On average, participants who consumed more rice, bread, or noodles were younger than those who consumed less. Women who ate more rice were less likely to drink alcohol, and men who ate more rice were more likely to be current smokers [11]. Men and women who ate more rice had a lower body mass index (BMI), reported higher levels of total physical activity, were more likely to work in primary industries and engage in strenuous physical activity at work or in their leisure time, and consumed less protein, fat, calcium, magnesium, dietary fiber, and coffee than those who ate less rice. Those who ate more bread were less likely to work in primary industries, both for men and women [12]. Men who ate more bread were less likely to smoke or drink alcohol regularly. Men's intake of calcium, magnesium, dietary fiber, coffee, and fat were all positively correlated with bread consumption. Men and women who ate more noodles had higher alcohol consumption rates and consumed more dietary fiber but less calcium. In this populace, sugars from

Table 1: Baseline characteristics of subjects according to categories of rice, bread, and noodle intake.

Empty Cell	Quartiles of rice intake			Quartiles of bread intake			Quartiles of noodle intake		
Empty Cell	Lowest	Highest	P for trend2	Lowest	Highest	P for trend2	Lowest	Highest	P for trend2
Men									
n	6805	4100		4412	6770		6284	5678	
Age (y)	57.0 ± 7.73	55.9 ± 7.0	<0.01	57.4 ± 7.5	56.5 ± 7.8	<0.01	57.2 ± 7.7	55.5 ± 7.3	<0.01
BMI (kg/m2)4	23.8 ± 3.0	23.4 ± 2.7	<0.01	23.5 ± 2.8	23.6 ± 2.9	0.2	23.4 ± 2.8	23.8 ± 2.9	<0.01
Current smoker (%)4	42	50	<0.01	50	43	<0.01	45	48	<0.01
Alcohol consumption ≥1 d/wk (%)4	68	67	0.04	78	58	<0.01	66	72	<0.01
Total physical activity (MET-h/d)4	33.1 ± 6.5	36.3 ± 6.6	<0.01	34.1 ± 6.9	34.1 ± 6.7	0.65	34.3 ± 6.7	34.1 ± 6.8	0.05
Strenuous physical activity ≥1 h/d (%)4 5	27	47	<0.01	33	33	0.28	33	33	0.29
Occupation (primary industries) (%)4	23	46	<0.01	35	29	<0.01	35	27	<0.01
Family history of diabetes (%)	7	9	<0.01	7	8	0.17	8	8	0.2
History of hypertension (%)	20	14	<0.01	21	15	<0.01	17	17	0.36
Food and nutrient intake									
Total energy intake (kcal/d)	2011 ± 727	2730 ± 705	<0.01	2126 ± 739	2467 ± 819	<0.01	1991 ± 608	2679 ± 829	<0.01
Protein (g/d)	76 ± 16	67 ± 11	<0.01	71 ± 16	74 ± 12	<0.01	71 ± 14	74 ± 13	<0.01
Fat (g/d)	64 ± 19	43 ± 11	<0.01	50 ± 17	59 ± 15	<0.01	54 ± 17	54 ± 14	0.68
Carbohydrate (g/d)	249 ± 49	330 ± 38	<0.01	271 ± 53	291 ± 47	<0.01	282 ± 51	287 ± 48	<0.01
Calcium (mg/d)	568 ± 259	407 ± 163	<0.01	475 ± 236	522 ± 213	<0.01	513 ± 249	482 ± 194	<0.01
Magnesium (mg/d)	291 ± 64	262 ± 44	<0.01	276 ± 62	280 ± 50	<0.01	276 ± 58	286 ± 53	<0.01
Dietary fiber (g/d)	12.7 ± 5.0	10.4 ± 3.6	<0.01	10.8 ± 4.7	12.5 ± 4.1	<0.01	11.2 ± 4.7	12.4 ± 4.1	<0.01
Rice (g/d)	226 ± 100	762 ± 103	<0.01	457 ± 195	415 ± 185	<0.01	456 ± 193	430 ± 184	<0.01
Bread (g/d)	28 ± 45	17 ± 25	<0.01	1 ± 1	59 ± 55	<0.01	18 ± 37	26 ± 37	<0.01
Noodles (g/d)	130 ± 131	118 ± 123	<0.01	107 ± 141	148 ± 145	<0.01	35 ± 12	274 ± 172	<0.01
Fruit (g/d)	177 ± 178	215 ± 209	<0.01	148 ± 162	239 ± 218	<0.01	165 ± 181	241 ± 215	<0.01
Vegetable (g/d)	209 ± 167	226 ± 177	<0.01	193 ± 175	238 ± 179	<0.01	180 ± 155	263 ± 193	<0.01
Fish (g/d)	89 ± 76	115 ± 90	<0.01	97 ± 86	107 ± 87	<0.01	80 ± 63	128 ± 98	<0.01
Coffee consumption ≥1 cup/d (%)4	38	25	<0.01	21	44	<0.01	29	34	<0.01
Women									
n	6593	3102		8959	8495		7187	7185	
Age (y)	56.7 ± 7.7	56.1 ± 7.2	0.04	58.8 ± 7.7	55.6 ± 7.6	<0.01	58.2 ± 8.1	56.1 ± 7.3	<0.01
BMI (kg/m2)4	23.6 ± 3.2	23.4 ± 3.1	0.02	23.5 ± 3.1	23.4 ± 3.1	0.02	23.4 ± 3.1	23.7 ± 3.1	<0.01
Current smoker (%)4	5	4	<0.01	5	4	0.72	4	5	<0.01
Alcohol consumption ≥1 d/wk (%)4	13	10	<0.01	11	11	0.14	8	14	<0.01
Total physical activity (MET-h/d)4	32.6 ± 5.5	33.9 ± 6.0	<0.01	32.7 ± 5.8	33.1 ± 5.7	<0.01	32.8 ± 5.7	33.1 ± 5.8	<0.01

Strenuous physical activity ≥1 h/d (%)[45]	16	25	<0.01	18	18	0.39	18	19	0.02
Occupation (primary industries) (%)4	16	44	<0.01	33	19	<0.01	27	25	0.02
Family history of diabetes (%)	8	8	0.1	7	9	<0.01	8	9	0.049
History of hypertension (%)	19	15	0.01	22	16	<0.01	21	18	<0.01
Food and nutrient intake									
Total energy intake (kcal/d)	1734 ± 663	2291 ± 669	<0.01	1710 ± 576	2173 ± 726	<0.01	1641 ± 544	2336 ± 724	<0.01
Protein (g/d)	73 ± 13	62 ± 9	<0.01	69 ± 11	66 ± 9	<0.01	67 ± 11	68 ± 10	<0.01
Fat (g/d)	65 ± 15	42 ± 9	<0.01	54 ± 14	56 ± 12	<0.01	57 ± 15	52 ± 11	<0.01
Carbohydrate (g/d)	229 ± 38	288 ± 30	<0.01	253 ± 38	256 ± 35	<0.01	250 ± 37	259 ± 36	<0.01
Calcium (mg/d)	650 ± 252	412 ± 150	<0.01	553 ± 225	524 ± 192	<0.01	572 ± 237	497 ± 176	<0.01
Magnesium (mg/d)	291 ± 59	248 ± 41	<0.01	281 ± 54	259 ± 44	<0.01	270 ± 53	270 ± 46	0.26
Dietary fiber (g/d)	15.1 ± 5.1	11.2 ± 3.5	<0.01	13.3 ± 4.8	13.3 ± 3.8	0.93	13.2 ± 4.8	13.4 ± 3.9	<0.01
Rice (g/d)	150 ± 89	608 ± 106	<0.01	370 ± 140	317 ± 137	<0.01	336 ± 138	348 ± 143	<0.01
Bread (g/d)	37 ± 53	23 ± 38	<0.01	3 ± 2	72 ± 58	<0.01	25 ± 44	34 ± 44	<0.01
Noodles (g/d)	98 ± 101	105 ± 119	0.46	75 ± 87	115 ± 118	<0.01	25 ± 11	217 ± 138	<0.01
Fruit (g/d)	251 ± 221	280 ± 227	<0.01	229 ± 207	304 ± 251	<0.01	217 ± 206	329 ± 260	<0.01
Vegetable (g/d)	251 ± 191	246 ± 181	0.71	231 ± 186	270 ± 194	<0.01	219 ± 171	299 ± 203	<0.01
Fish (g/d)	88 ± 76	109 ± 81	<0.01	86 ± 71	103 ± 81	<0.01	72 ± 61	124 ± 88	<0.01
Coffee consumption ≥1 cup/d (%)4	43	28	<0.01	23	52	<0.01	34	37	<0.01

rice, bread, and noodle admissions represented 51.9%, 3.3%, and 7.4% of the all-out carb consumption, separately, in men and for 46.4%, 4.6%, and 6.3% of the complete carb admission, separately, in ladies [13].

Discussion

The consumption of rice was found to be associated with a higher risk of type 2 diabetes in women in this large-scale, population-based, prospective study of adults in Japan. A huge expansion in risk was seen in ladies with rice admissions ≥3 bowls (420 g)/d [14]. The relationship between rice admission and type 2 diabetes risk was especially articulated in truly latent ladies, non-obese ladies, ladies who worked in positions other than essential ventures, and ladies who didn't add minor grains to rice. Although there was a suggestion of an increased risk of type 2 diabetes with rice intake in physically inactive men and smoking men, the overall association in men was unclear. Bread or noodle admission was not related with chance of type 2 diabetes. Our study confirmed a previous finding that rice consumption is associated with type 2 diabetes in Chinese women [15].

A previous finding from a population in China, where white rice is a major staple food, is consistent with the current finding of an increased risk of type 2 diabetes associated with increased rice consumption. In that past review, ladies who consumed ≥300 g rice/d had a 1.8-overlay more serious gamble of creating type 2 diabetes than did ladies who consumed <200 g rice/d. A US study found a connection between diabetes risk and white rice consumption. In addition, it appeared that our findings were consistent with dietary pattern analyses of Japanese populations [16]. Nanri et al revealed a higher commonness of raised glycated hemoglobin focuses in people with a high dietary example score described by regular rice consumption than in those with a low score. In an age- and area-adjusted model, we found that men who ate more bread had a lower risk of type 2 diabetes, which was in line with previous findings from a Japanese study. In any case, in our ongoing review, this opposite affiliation became nonsignificant after change for covariates, including calcium and espresso admission. The role of milk and coffee as confounders may explain the apparent protective association between bread consumption and type 2 diabetes risk in Japan, where they have been linked to a lower risk of type 2 diabetes [17]. That's what taken together, these information proposed, in Japanese, more prominent rice utilization adds to an expanded gamble of type 2 diabetes, though a bread-eating dietary example (however not be guaranteed to bread essentially) is connected with a diminished gamble.

Acknowledgement

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Conflict of Interest

None

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