

Dietary and Life Habits of Obesity and Brown Rice Eaters among Genmai Evidence for Nutritional Kenko Innovation (GENKI) Study I and II

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Abstract

The relationship between diet and health is a field that requires more research in an ultra-aging society. A questionnaire survey was conducted, to compare groups of brown rice and natural foods eaters, with residential population to clarify the relationship between the brown rice eaters and obese people. The total number of respondents was 7183. The odds ratio to be obesity was 1.67 among white rice eaters, while it was 0.48 among brown rice eaters.

The consumption of food items as side dishes showed a characteristic trend among white rice eaters, while it was 0.48 among brown rice eaters. Brown rice eaters consumed significantly more carrots, green yellow vegetables, burdock, lotus roots, pumpkin, sweet potatoes, yam, sesame, salty plum pickles (umeboshi), peanut, chestnut, mushrooms, dried mushrooms (shiitake), sea weed (nori, konbu), red bean (azuki), and soy milk. They did not consume meat and fish, but soy protein and other plant protein substituted to meat and fish.

The polished white rice eaters of obesity group preferentially consumed sweet bread, broccoli, bell pepper, eggplant, banana, grapefruit, red meat fish like tuna, beef, cow and pig meat, egg, dairy products, sugar, and mayonnaise. They also consumed coffee and soft drinks, chocolate, cakes, ice cream and jelly.

Brown rice contains many functional ingredients that have various effects on physiological functions, such as innate immunity, recognition, etc., so these should be effective in aging and post corona society.

Keywords: Brown Rice; Obesity; Dietary Habits; Life Habits; Functional Ingredient

Introduction

The obesity has been the main cause of type 2 diabetes in the world, but the Asian risk in developing diabetes mellitus caused by obesity was several times higher than that of Westerners [1]. The incidence rate of diabetes mellitus among Westerners was only 7-8% at BMI 30 kg/m², but it reached about 25% among Japanese at the same BMI. Furthermore, the insulin secretory ability declined with aging, then diabetes patients became a national disease like cancer in the aging society [2].

After implementation of "Healthy Japan21" as an approach to prevent obesity by diet and physical activity, the number of patients with metabolic syndrome remained flat. But the number of patients with diabetes continued to increase and reached almost 10 million now in Japan [3-6]. Therefore, it is the most important to decrease the number of patients with diabetes and its complication by preventing obesity [5-10].

We have studied to substantiate the health promotion effect of brown rice by the Genmai Evidence for Nutritional Genki Innovation (GENKI) Study 1 and 2 [11,12] and investigated in detail of the daily life, eating habits and particularly about food of obese people, and analyzed it in comparison with the self-rating of health status and the degree of vitality of brown rice eaters by cohort studies of 7183 participants. This study focused on the eating habits of obese people in comparison with brown rice eaters by combining GENKI1 and GENKI2 Study participants.

Ethical issue

The current study protocol has been reviewed and approved by the Ethics Review Board of the Life Science Promoting Association (#002-2016). Signed agreement to participate in the study was collected at the time of first questionnaire survey. Each participant’s data were given an ID number for statistical analysis, and it was made anonymous to protect privacy.

Methods

Recruiting participants for the study was announced in a local magazine or pamphlets at their workplace, mostly macrobiotic vegetarians participated more than 1200 people, in “GENKI Study I” (hereinafter, this is called “GENKI I”). A total 5983 people have participated in the survey of “GENKI Study II” (hereinafter, this is called “GENKI II”) from more than 30 workplaces concerning food or agriculture. The participants were staff members and their family members from Rice companies (19%), Agricultural Cooperative Associations (46%), restaurants, nutrition schools, etc., who lived in different areas of Japan.

GENKI I and II recruited participants of both men and women aged 20 - 79 and the questionnaire comprehensively asked about the past medical history, current symptoms, what kind of rice to eat as staple food, eating habits, taste for food, ingestion state of food, lifestyle, etc. The questionnaire was open on <http://lifescience.or.jp>. We created the Excel database and analyzed in IBM-SPSS ver. 24. For easy comparison, the odds ratio (OR) of obese group and non-obese group, and in brown rice group OR against non-brown rice group was shown for each factor in the tables 1-4.

Results

Obese people in the participants with BMI more than 25 kg/m² or higher was 1243 out of 7169. The obese people were already pre-obese (OR 8.74) or Obese-class I (OR 46.76) when they had been 20 years old, so these were a risk of obesity in later life.

As for the kind of staple food for obese people were mostly polished white rice and the odds ratio (OR) to be obese was 1.68, in contrast with that brown rice was less than half (OR 0.45) (Table 1).

	Type of rice	Total	Obesity	%	OR	p	
1	Polished white rice	4774	922	19%	1.68	0.00	***
2	Half-polished rice	376	49	13%	0.69	0.02	*
3	Haiga-mai (rice bud rich)	122	22	18%	1.12	0.64	
4	Brown rice	777	67	9%	0.45	0.00	***
5	Mixture of 16 different kinds of cereals	306	45	15%	0.99	0.97	
6	Kinmemai rice (Partial removal of bran layer)	579	97	17%	0.94	0.58	
7	Wax free brown rice	235	41	17%	0.92	0.65	

Table 1: Rice and risk of obesity.

The answer of current health conditions in obese people were mostly “Not healthy” (OR 1.71) and “Not very healthy” (OR 1.84) and the answer to “Very healthy” was low (OR 0.51). On the contrary, in the answer in brown rice eaters “Not healthy” were less, (OR 0.87) and “Healthy” (OR 1.79) was most frequent. This trend was also seen in the answer of “Health status compared to one year before”, and many obese people answered “Worse” (OR 1.41), few were “Better” (OR 0.60), that was opposite results in brown rice eaters.

The past medical history of diseases in obese people showed significantly high risk in many lifestyle related diseases, such as diabetes (OR 2.36), hypertension (OR 2.98), asthma (OR 1.33), bronchitis (OR 2.72), and gallstones (OR 1.88). Current prescribed drug use showed also high OR for many lifestyle related diseases among obese people, while brown rice eaters showed almost one tenth OR in hypertension, angina, and hyperlipidemia (Table 2).

The past medical history showed higher odds ratios for allergies (OR 1.45) and cystitis (OR 1.61) in brown rice eaters. The anti-allergic effects of brown rice had been well known, so dietary change to brown rice could be happen, expecting an improvement of the diseases.

Regarding a stress, many obese people answered “Strong” (OR 1.40), but many of the brown rice eaters answered “Not so much” (OR 1.69), and significantly fewer “Strong” (OR 0.81). Only a small

		Obesity Group						Brown rice eater Group					
		Total	Answer	%	OR	p		Answer	%	OR	p		
Have you ever been told by a doctor that you have the following illness?													
1	No	3117	460	14.8%	0.69	0.000	***	366	11.7%	0.88	0.107		
2	Diabetes Mellitus	226	88	38.9%	2.36	0.000	***	31	13.7%	0.86	0.475		
3	Stroke	16	5	31.3%	1.52	0.452		2	12.5%	0.39	0.373		
4	Hypertension	750	275	36.7%	2.98	0.000	***	80	10.7%	0.48	0.000	***	
5	Angina	71	23	32.4%	1.52	0.127		6	8.5%	0.44	0.062		
6	Asthma	353	75	21.2%	1.33	0.045	*	52	14.7%	1.18	0.305		
7	Bronchitis	54	19	35.2%	2.72	0.001	**	12	22.2%	1.60	0.167		
8	Allergy	807	133	16.5%	0.99	0.934		144	17.8%	1.45	0.000	***	
9	Kidney disease	78	16	20.5%	1.12	0.702		20	25.6%	1.50	0.159		
10	Cystitis	336	44	13.1%	1.06	0.750		80	23.8%	1.61	0.001	***	
11	Hepatitis	32	10	31.3%	1.05	0.906		3	9.4%	0.67	0.515		
12	Gastric ulcer	349	68	19.5%	0.85	0.267		49	14.0%	0.90	0.533		
13	Gallstone	144	45	31.3%	1.88	0.001	**	19	13.2%	0.72	0.214		
Are you currently taking any medicines prescribed by your doctor?													
1	Yes	4349	642	14.8%	0.53	0.000	***	653	15.0%	2.11	0.000	***	
2	No	1702	439	25.8%	1.89	0.000	***	180	10.6%	0.46	0.000	***	
What medicine do you take?													
1	Diabetes Mellitus	155	67	43.2%	2.86	0.000	***	17	11.0%	0.69	0.157		
2	Hypertension	620	238	38.4%	3.10	0.000	***	55	8.9%	0.35	0.000	***	
3	Angina	41	17	41.5%	2.07	0.034	*	2	4.9%	0.23	0.044	*	
4	Hyperlipidemia	262	107	40.8%	2.97	0.000	***	21	8.0%	0.39	0.000	***	
5	Hyperuricemia	76	38	50.0%	2.70	0.000	***	6	7.9%	0.53	0.174		
7	Other	942	174	18.5%	1.04	0.712		114	12.1%	0.68	0.001	***	

Table 2: Past medical history, Medicine use of participants.

number of brown rice eaters received regular health checkups, which might be related to that they had high health feeling, so not felt the necessity to go to the annual health checkup.

The physical activity level of the obese people was low compared to the non-obese people, and most of their work was sedentary and used a car when they moved. On the other hand, many brown rice eaters walked about 7,000 to 8,000 steps every day, and often did heavy work and intense exercise. Brown rice eaters slept 6-8 hours, waked up in good feeling in the morning, and refreshed (Table 3). As healthy eating habits, brown rice eaters often paid

attention to select vegetable foods, low salt foods, small meals, and vegetarian foods. Even if obese people had health-consciousness, such as eating from vegetables and taking a low-carbohydrate diet, but many obese people preferred to eat oily foods, rich seasonings, oily, food, and people were eating until they were full (Table 3). These tended to be opposite for brown rice eaters.

As for supplements, many brown rice eaters decided to use it, and they took multi-mineral, vitamin B, vitamin C, iron, DHA and EPA, enzyme drink, fermented rice bran, amino acid/peptide, and

		Obesity Group						Brown rice eater Group				
		Total	Answer	%	OR	p		Answer	%	OR	p	
Select your physical activity level												
1	Mostly sitting work, moving mainly by car	2200	474	21.5%	1.22	0.007	**	199	9.0%	0.71	0.000	***
2	Indoor work, housework, outing	2689	394	14.7%	0.92	0.273		454	16.9%	1.09	0.312	
3	Walk 7,000 to 8,000 steps every day	789	146	18.5%	0.87	0.197		135	17.1%	1.34	0.009	**
4	Doing hard work or strenuous exercise	437	82	18.8%	0.89	0.388		72	16.5%	1.65	0.001	***
Do you wake up in the morning?												
1	I can't get up easily	1170	166	14.2%	0.93	0.456		121	10.3%	0.80	0.052	
2	Tiredness	2071	424	20.5%	1.28	0.001	***	189	9.1%	0.65	0.000	***
3	Yes	2831	493	17.4%	0.82	0.006	**	531	18.8%	1.69	0.000	***
What do you practice as a diet?												
1	Eat from vegetables	2402	446	18.6%	1.42	0.000	***	335	13.9%	1.07	0.374	
2	Take 5 or more servings of vegetables and 200g of fruit daily	95	15	15.8%	1.10	0.738		22	23.2%	1.26	0.367	
3	Take 350g of vegetables daily	239	33	13.8%	0.89	0.563		68	28.5%	2.09	0.000	***
4	Do not eat full	459	44	9.6%	0.46	0.000	***	102	22.2%	1.87	0.000	***
5	Vegetable diet	533	47	8.8%	0.49	0.000	***	232	43.5%	5.52	0.000	***
Do you usually eat to full stomach?												
1	Eat to full stomach	2635	558	21.2%	1.72	0.000	***	318	12.1%	1.00	0.989	
2	Do not overeat	3186	447	14.0%	0.62	0.000	***	416	13.1%	0.95	0.505	
3	Eat about half	187	19	10.2%	0.54	0.014	*	28	15.0%	1.08	0.711	
Please choose the closest food preference												
Oily food												
1	Hardly eat	1029	93	9.0%	0.50	0.000	***	310	30.1%	3.42	0.000	***
2	Modest	3961	659	16.6%	0.90	0.139		383	9.7%	0.44	0.000	***
3	Eat willingly	1039	282	27.1%	1.96	0.000	***	67	6.4%	0.62	0.000	***
Oily meat food (fatty meat, chicken skin)												
1	Hardly eat	2519	287	11.4%	0.59	0.000	***	533	21.2%	2.78	0.000	***
2	Modest	2916	576	19.8%	1.21	0.009	**	213	7.3%	0.43	0.000	***
3	Eat willingly	636	173	27.2%	1.75	0.000	***	32	5.0%	0.51	0.000	***
Supplements												
1	Not Use	4191	745	17.8%	1.08	0.353		388	9.3%	0.46	0.000	***
2	Use	1754	273	15.6%	0.94	0.476		353	20.1%	1.96	0.000	***
What kind of supplements do you use?												
1	Multi-vitamin	383	64	16.7%	0.99	0.968		56	14.6%	1.20	0.234	
2	Multi mineral	190	32	16.8%	1.00	0.994		41	21.6%	1.81	0.001	**
3	Vitamin B	240	36	15.0%	0.93	0.706		52	21.7%	1.78	0.001	***

4	Vitamin C	377	41	10.9%	0.69	0.035	*	84	22.3%	1.71	0.000	***
5	Vitamin E	176	21	11.9%	0.76	0.254		27	15.3%	0.91	0.672	
6	Iron	235	23	9.8%	0.68	0.090		46	19.6%	1.63	0.005	**
7	Calcium	209	30	14.4%	0.97	0.897		40	19.1%	1.16	0.433	
8	DHA · EPA	197	50	25.4%	1.64	0.004	**	46	23.4%	1.84	0.001	***
9	Energy drink	169	28	16.6%	0.93	0.729		21	12.4%	0.93	0.771	
10	Enzyme drink	97	9	9.3%	0.58	0.132		46	47.4%	5.59	0.000	***
11	Fermented rice bran	133	23	17.3%	0.88	0.596		51	38.3%	4.70	0.000	***
12	Dietary fiber	196	36	18.4%	1.31	0.165		31	15.8%	1.02	0.921	
13	Oligosaccharide	74	19	25.7%	2.26	0.004	**	14	18.9%	1.15	0.640	
14	Chondroitin sulfate	61	14	23.0%	1.78	0.069		9	14.8%	0.68	0.291	
15	Amino acid/Peptide	99	16	16.2%	0.95	0.864		23	23.2%	1.64	0.049	*
16	Probiotics	316	67	21.2%	1.49	0.007	**	58	18.4%	1.24	0.168	
17	Ginkgo leaf extract	23	5	21.7%	1.31	0.600		9	39.1%	3.52	0.005	**

Table 3: Activity and sleep, diet, eating habits, preferences of participants.

ginkgo leaves. The educational background was higher in brown rice eaters, with less than 10% being middle and high school graduates.

Regarding individual food intake, brown rice eaters and obese people showed the remarkable contrast (Table 4).

Brown rice eaters seldom ate bread and cereals, but buckwheat was taken. Odds ratio of Azuki bean intake was very high (12.33). They took green yellow vegetables, pumpkin and carrot, and mushroom (shiitake), chestnut and sesame, but the intake of chicken, beef, pork, ham and bacon was significantly low. Soy bean protein, like natto and tofu substituted to animal protein. They did not take sugar and drank persimmon leaves tea. Obese people showed the reverse trends. They consumed beef, ham, bacon sausage, chicken and pork, and preferred to take soft drink, while green yellow vegetables and carrot intake was low compared to the non-obese people.

Discussion

Many epidemiology studies reported that high whole grain intake was associated with low risk of all-cause, cardiovascular, and cancer mortality [13-18]. Type 2 diabetes increased proportionally with BMI, and these could connect with other dietary and lifestyle factors [19,20]. It is often said that dietary restrictions and

exercise were used to reduce the body weight of obesity, but it was difficult to succeed [7]. We confirmed the health condition of obese people were related to their past medical history and current use of medicine [11,12]. In particular, drugs for lifestyle related diseases, such as diabetes, hypertension, angina, hyperlipidemia and hyperuricemia were administered at an odds ratio of 2 - 3 among obese people. The fact that the risk of obesity was clearly shown by the odds ratio with respect to non-obese people suggests the necessity to prevent lifestyle related diseases by improving obesity.

The obesity people have characteristics in their dietary habits, such as preferring meat, no vegetables, oily foods, and eating until they became full. They had mostly sedentary occupation and moved mainly by car, and they were difficult to wake up in the morning, had a stressful lifestyle. Brown rice eaters consumed more healthy foods such as soy products, vegetable and sea-weeds, which include rich fiber, than those of white rice eaters. Therefore, the obese people need to voluntarily improve their lifestyle and change their behavior.

As we succeeded in the SCOP (SAKU Control Obesity Program) [5,8], it was shown that obesity cannot be eliminated only by restricting calorie intake, and it was necessary to make behavioral change by existential therapeutic approach. The measures against

Food and Food intake		Obesity Group				Brown rice eater Group				Food and Food intake		Obesity Group				Brown rice eater Group					
		Total	An-swer	OR	p	An-swer	OR	p				Total	An-swer	OR	p	An-swer	OR	p			
Bread, Roll, French bread		Sesami																			
1	Hardly eat	1163	235	1.14	0.13		192	1.63	0.00	***	1	Hardly eat	1197	238	1.11	0.23		58	0.37	0.00	***
2	3-4 times a week	570	91	1.00	0.97		80	1.10	0.46		2	3-4 times a week	714	97	0.81	0.07		139	1.62	0.00	***
3	Once a day	1241	170	0.79	0.01	*	79	0.32	0.00	***	3	Once a day	343	39	0.67	0.03	*	117	3.01	0.00	***
Cereal		Peanuts, Almonds, Pine nuts																			
1	Hardly eat	4891	865	1.10	0.30		576	0.64	0.00	***	1	Hardly eat	2786	495	1.13	0.08		186	0.36	0.00	***
2	3-4 times a week	99	10	0.60	0.13		20	1.70	0.04	*	2	3-4 times a week	291	43	0.83	0.28		86	2.82	0.00	***
3	Once a day	86	10	0.66	0.22		7	0.56	0.14		3	Once a day	164	23	0.82	0.40		41	1.63	0.01	*
Noodles (Udon, Rahmen, Pasta)		Chestnut																			
1	Hardly eat	331	52	0.92	0.62		72	1.65	0.00	***	1	Hardly eat	4562	799	1.07	0.41		427	0.41	0.00	***
2	3-4 times a week	753	157	1.28	0.01	*	93	1.11	0.40		2	3-4 times a week	67	9	0.92	0.82		19	2.05	0.01	*
3	Once a day	102	22	1.31	0.28		18	1.36	0.25		3	Once a day	25	4	1.39	0.56		12	5.64	0.00	***
Buck wheat		Mushrooms (Shiitake, Shimeji, Enoki)																			
1	Hardly eat	2228	338	0.91	0.22		202	0.56	0.00	***	1	Hardly eat	306	58	1.00	0.99		30	0.96	0.83	
2	3-4 times a week	137	39	1.71	0.01	**	24	1.50	0.08		2	3-4 times a week	1520	254	1.08	0.33		197	0.97	0.76	
3	Once a day	21	4	0.86	0.79		7	3.68	0.01	**	3	Once a day	462	59	0.85	0.25		96	1.48	0.00	**
Onion, Green Onion		Dried shiitake																			
1	Hardly eat	90	20	1.49	0.14		8	0.87	0.71		1	Hardly eat	2459	437	1.13	0.08		142	0.32	0.00	***
2	3-4 times a week	1955	318	0.90	0.16		220	0.86	0.08		2	3-4 times a week	332	68	1.31	0.06		107	3.46	0.00	***
3	Once a day	877	137	1.02	0.84		154	1.34	0.00	**	3	Once a day	99	12	0.77	0.41		48	5.42	0.00	***
Carrot		Tomato																			
1	Hardly eat	191	44	1.36	0.09		8	0.34	0.00	**	1	Hardly eat	654	140	1.31	0.01	**	73	1.01	0.96	
2	3-4 times a week	1769	296	0.97	0.73		222	0.96	0.66		2	3-4 times a week	1191	199	0.97	0.73		142	0.92	0.38	
3	Once a day	664	89	0.83	0.12		130	1.51	0.00	***	3	Once a day	452	72	1.02	0.86		60	0.77	0.08	

Pumpkin										Burdock											
1	Hardly eat	1031	201	1.11	0.26		55	0.39	0.00	***	1	Hardly eat	1013	192	1.15	0.13		43	0.31	0.00	***
2	3-4 times a week	458	70	0.90	0.43		86	1.61	0.00	***	2	3-4 times a week	493	79	0.93	0.59		139	2.91	0.00	*
3	Once a day	117	20	1.10	0.70		34	2.63	0.00	***	3	Once a day	69	12	1.11	0.74		22	2.79	0.00	***
Green leafy vegetables (Spinach)										Lotus root											
1	Hardly eat	162	30	0.98	0.94		7	0.38	0.01	*	1	Hardly eat	1705	329	1.19	0.02	*	77	0.28	0.00	***
2	3-4 times a week	1618	254	0.86	0.06		198	0.97	0.72		2	3-4 times a week	355	56	0.91	0.56		104	2.90	0.00	***
3	Once a day	691	96	0.82	0.09		156	1.89	0.00	***	3	Once a day	54	11	1.50	0.24		18	2.91	0.00	***
Broccoli										Potato											
1	Hardly eat	548	109	1.09	0.47		47	0.76	0.10		1	Hardly eat	271	41	0.86	0.39		69	2.77	0.00	***
2	3-4 times a week	1001	177	1.13	0.21		135	1.00	0.99		2	3-4 times a week	1499	239	0.93	0.41		163	0.77	0.01	***
3	Once a day	267	45	1.07	0.70		54	1.51	0.01	*	3	Once a day	167	41	1.91	0.00	***	23	0.92	0.73	***
Banana										Chicken											
1	Hardly eat	2154	388	1.04	0.63		340	1.84	0.00	***	1	Hardly eat	400	35	0.48	0.00	***	197	6.62	0.00	***
2	3-4 times a week	402	64	1.00	1.00		47	0.76	0.10		2	3-4 times a week	1384	259	1.27	0.00	**	90	0.44	0.00	***
3	Once a day	368	53	0.85	0.30		54	0.86	0.35		3	Once a day	86	26	2.30	0.00	***	7	0.65	0.29	
Apple										Beef											
1	Hardly eat	1491	312	1.27	0.00	**	129	0.73	0.00	**	1	Hardly eat	1151	149	0.78	0.01	*	358	4.12	0.00	***
2	3-4 times a week	479	68	0.84	0.21		79	1.17	0.24		2	3-4 times a week	489	101	1.24	0.08		29	0.49	0.00	***
3	Once a day	323	32	0.59	0.01	**	73	1.38	0.03	*	3	Once a day	25	13	5.73	0.00	***	0	0.00	0.94	
Citrus (Mandarin, Orange, Grapefruit)										Pork											
1	Hardly eat	1174	228	1.06	0.48		145	1.24	0.04	*	1	Hardly eat	385	26	0.36	0.00	***	218	9.82	0.00	***
2	3-4 times a week	717	115	1.00	0.97		106	1.02	0.87		2	3-4 times a week	1826	324	1.20	0.02	*	121	0.39	0.00	***
3	Once a day	360	51	0.95	0.77		63	0.93	0.61		3	Once a day	97	23	1.85	0.01	*	4	0.29	0.02	*
Strawberry										Hum, bacon, Vienna sausage											
1	Hardly eat	1811	337	1.02	0.77		246	1.35	0.00	***	1	Hardly eat	848	88	0.55	0.00	***	372	8.10	0.00	***
2	3-4 times a week	315	51	1.11	0.51		35	0.67	0.03	*	2	3-4 times a week	1101	203	1.18	0.07		53	0.32	0.00	***
3	Once a day	80	9	0.72	0.36		14	1.08	0.80		3	Once a day	193	52	2.18	0.00	***	7	0.22	0.00	***

Food and Food intake		Obesity Group				Brown rice eater Group				Food and Food intake		Obesity Group				Brown rice eater Group				
		Total	An-swer	OR	p	An-swer	OR	p				Total	An-swer	OR	p	An-swer	OR	p		
Azuki been										Red-flesh fish (Salmon, Tuna, Bonito)										
1	Hardly eat	3220	556	0.95	0.56	181	0.27	0.00	***	1	Hardly eat	575	81	0.84	0.18	175	3.71	0.00	***	
2	3-4 times a week	140	24	1.12	0.62	53	3.65	0.00	***	2	3-4 times a week	412	80	1.14	0.34	36	0.56	0.00	**	
3	Once a day	67	7	0.67	0.33	48	12.33	0.0	***	3	Once a day	42	8	1.22	0.62	7	1.16	0.73		
Boiled beans (Soybeans, black beans, Kintoki beans)										Silver-skinned fish (Horse mackerel, Sardine, Saury)										
1	Hardly eat	2116	374	1.05	0.53	165	0.59	0.00	***	1	Hardly eat	783	115	0.97	0.81	138	1.69	0.00	***	
2	3-4 times a week	282	37	0.76	0.14	69	1.92	0.00	***	2	3-4 times a week	362	65	1.02	0.88	57	1.08	0.62		
3	Once a day	100	10	0.55	0.08	28	1.96	0.00	**	3	Once a day	24	4	1.03	0.96	5	1.36	0.55		
Tofu, Deep-fried tofu										Scallops										
1	Hardly eat	228	39	0.94	0.73	21	0.92	0.74		1	Hardly eat	3989	653	0.89	0.10	493	0.97	0.68		
2	3-4 times a week	1570	240	0.88	0.10	220	1.16	0.21		2	3-4 times a week	52	8	0.95	0.90	10	1.44	0.32		
3	Once a day	575	90	1.00	0.98	108	1.24	0.07		3	Once a day	3	0	0.00	0.95	2	6.58	0.13		
Natto, Tempeh										Vegetable prtein (Raw, Seitan)										
1	Hardly eat	1230	217	0.97	0.70	78	0.42	0.00	***	1	Hardly eat	5173	885	1.06	0.56	471	0.18	0.00	***	
2	3-4 times a week	953	156	1.02	0.87	147	1.26	0.02	*	2	3-4 times a week	61	18	2.02	0.02	16	3.20	0.00	***	
3	Once a day	520	85	1.00	0.95	119	1.84	0.00	***	3	Once a day	12	2	1.27	0.76	4	3.06	0.07		
Eggs (Chikin Eggs, Quail eggs)										Sugar (White sugar, Beet sugar)										
1	Hardly eat	280	31	0.63	0.02	*	142	7.73	0.00	***	1	Hardly eat	1012	188	0.97	0.72	267	3.41	0.00	***
2	3-4 times a week	1654	282	1.00	0.99	153	0.66	0.00	***	2	3-4 times a week	934	164	1.08	0.42	98	0.83	0.11		
3	Once a day	1156	213	1.13	0.17	75	0.39	0.00	***	3	Once a day	1126	177	0.98	0.80	76	0.37	0.00	***	
Milk										Honey										
1	Hardly eat	1991	288	0.70	0.00	***	457	3.74	0.00	***	1	Hardly eat	3345	618	1.08	0.26	376	0.86	0.06	
2	3-4 times a week	632	124	1.26	0.03	*	39	0.43	0.00	***	2	3-4 times a week	252	31	0.81	0.28	40	1.12	0.54	
3	Once a day	1120	189	1.02	0.87	71	0.35	0.00	***	3	Once a day	214	32	0.99	0.94	36	1.05	0.80		

Yoghurt, Fermented milk drink										Green tea											
1	Hardly eat	1322	212	0.77	0.00	**	326	3.58	0.00	***	1	Hardly eat	916	118	0.67	0.00	***	223	2.92	0.00	***
2	3-4 times a week	772	127	1.03	0.77		68	0.61	0.00	***	2	3-4 times a week	603	117	1.19	0.12		71	1.00	0.99	
3	Once a day	1294	189	0.89	0.21		109	0.43	0.00	***	3	Once a day	948	181	1.12	0.22		91	0.65	0.00	***
Cheese										Persimmon leaves tea											
1	Hardly eat	1448	256	0.96	0.59		289	2.12	0.00	***	1	Hardly eat	5797	995	1.15	0.43		663	0.22	0.00	***
2	3-4 times a week	701	126	1.21	0.08		80	0.86	0.22		2	3-4 times a week	21	3	0.83	0.77		9	6.17	0.00	***
3	Once a day	260	29	0.70	0.08		20	0.43	0.00	***	3	Once a day	14	3	1.85	0.36		9	7.75	0.00	***
Soymilk										Soft drink (Juice, Carbonated drink)											
1	Hardly eat	4023	736	1.09	0.24		260	0.22	0.00	***	1	Hardly eat	2894	354	0.55	0.00	***	566	2.64	0.00	*
2	3-4 times a week	232	29	0.82	0.34		64	2.65	0.00	***	2	3-4 times a week	482	119	1.57	0.00	***	24	0.46	0.00	
3	Once a day	262	33	0.84	0.37		88	3.00	0.00	***	3	Once a day	190	54	1.55	0.01	*	13	0.67	0.17	***
Wakame, Hijiki										Wine											
1	Hardly eat	400	85	1.17	0.22		20	0.41	0.00	***	1	Hardly eat	4362	755	1.17	0.05		473	0.54	0.00	*
2	3-4 times a week	1122	183	1.00	0.97		184	1.38	0.00	***	2	3-4 times a week	134	18	0.71	0.19		30	2.13	0.00	
3	Once a day	326	43	0.86	0.37		92	2.25	0.00	***	3	Once a day	76	6	0.38	0.02	*	17	1.78	0.04	
Mozuku, Mekabu										Chocolate, Cookie											
1	Hardly eat	2523	424	0.97	0.71		220	0.59	0.00	***	1	Hardly eat	896	165	0.86	0.13		182	2.18	0.00	
2	3-4 times a week	278	53	1.29	0.11		65	1.80	0.00	***	2	3-4 times a week	1480	300	1.14	0.09		202	1.17	0.09	
3	Once a day	62	13	1.53	0.19		22	2.59	0.00	***	3	Once a day	391	56	1.05	0.75		34	0.54	0.00	***
Mayonnaise										Cake (Cake, Castilla, Cream puff)											
1	Hardly eat	935	128	0.76	0.01	**	268	3.79	0.00	***	1	Hardly eat	1620	275	0.80	0.01	**	302	2.14	0.00	*
2	3-4 times a week	1216	228	1.49	0.10		92	0.51	0.00	***	2	3-4 times a week	203	36	1.27	0.22		20	0.75	0.24	
3	Once a day	252	49	1.20	0.28		17	0.45	0.00	**	3	Once a day	25	4	1.41	0.54		2	0.49	0.34	***
Herb tea										Ice cream											
1	Hardly eat	4632	843	1.14	0.16		444	0.38	0.00	***	1	Hardly eat	2039	285	0.65	0.00	***	397	2.11	0.00	
2	3-4 times a week	132	19	1.12	0.66		31	2.01	0.00	**	2	3-4 times a week	309	61	1.30	0.08		34	0.95	0.78	
3	Once a day	81	10	0.80	0.52		25	2.68	0.00	***	3	Once a day	63	15	1.51	0.17		3	0.29	0.04	***

Table 4: Food intake in obese and brown rice diets.

metabolic syndrome have been accepted by “Healthy Japan 21”, but we are considering that there is not enough for psychological support as a part of the individual support.

In contrast to the obese people, the brown rice eaters were in excellent health condition and almost no obese. There was fewer past medical history, and odds ratios for drug use such as for hypertension, hyperlipidemia, and angina were 0.2 - 0.3 [11,12]. In the changes of healthy feeling from the last year, OR of “Better” was 3.74 among brown rice eaters, which contrasted with OR of 0.6 for obese people. They seemed not to want to eat meat or to go for a health checkup because brown rice eaters had healthy feeling by getting enough nutrition from brown rice. Recently functional ingredients of brown rice became the evidence of recommendation [21-25].

Many brown rice eaters have a high educational background, and it would be a reason why the knowledge about the nutrition of brown rice was linked to the choice of brown rice. Many brown rice eaters took supplements, so it was also a reflection of their health consciousness.

The food intake and dietary habits have many implications for the post corona society and future aging society [26]. Besides, grain consumption’s ratio in carbohydrates has been reduced during the past 40 years in Japan. Especially when dealing with the percentage of rice consumption, “rice and rice products” has become under 50%.

Much more intervention studies are needed to accumulate enough evidence to recommend consumption of brown rice of whole grain or other types of processed rice (we call these kind of rice as “Medical Rice”). This is a new concept of the rice which has the functional effect for disease prevention and dietary therapy as “Medical Rice” [27-29].

For implementing the strategy of “Rice change” behavior as the “supportive social environment” approach, we consider to more effective developing partnership among consumer, food processor, and producer. So, Watanabe, *et al.* has constructed “Medical Rice Association” in 2019. The association’s members joined from diversified areas and their backgrounds were medical specialists, nutritionists, agricultural members [27,28].

As the recommendation strategy of variety foods intake for aged people, changing staple food to brown rice of whole grain may associate with increasing healthy side dish food intake. From two large-scale epidemiologic studies conducted in Greece [16], higher intake of whole grains evaluated by mainly “whole wheat” of bread was associated with a higher level of “successful aging” index. These were evaluated by 10 attributes such as health-related, social lifestyle and clinical factors.

We recently found that rice eating countries showed the less incidence and mortality of COVID-19 [24].

There are many additional benefit in brown rice eating.

WHO had proposed the importance of food based guideline. Our proposal is coincided with the WHO recommendation. Relationship of intestinal microbiota and health further support the importance of Genmai eating. Health related factors of rice should be a possible future research topic. Therefore, much more scientific evidence for healthy rice is needed for implementation of “dietary education” and “supportive environment” for healthy people and preliminary one.

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Conflict of Interest

The authors had no declaration of COI.

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