Comparison of Various Foods Intakes and Their Relationships with Body Mass Index in Japanese Old Men and Women

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Abstract

Objective: Obesity is an important health problem, leading to many metabolic diseases such as type2 diabetes mellitus, cardiovascular diseases, cancer etc. There are many diet proposals to combat obesity. Since obesity is relatively rare in Japan, we wanted to know what kinds of foods influence body mass index (BMI) in old Japanese people. Methods: Healthy participants were given self-administered diet history questionnaires and described answers on each item by recollection of diets they took (7 days dietary recall). We used a brief-type self-administered diet history questionnaire (BDHQ) by using which the Japanese Ministry of Health, Labour and Welfare reports national Nutrition Surveys. From these questionnaires, we calculated the intakes of energy, carbohydrate, fat, protein or other foods. Results: Men take more alcohol, salt fruit, beans, and eggs than women. Intakes of major foods such as carbohydrate, lipid, and protein did not influence BMI in men and women. Conclusion: Within the range of foods intakes in Japan, no restriction of any food such as carbohydrate is not necessary for staying lean.

Keywords

Carbohydrate, Protein, Fish, Glucose, Insulin, BMI (Body Mass Index), Obesity

1. Introduction

Obesity has been dramatically increased world-widely and to know the effective and safe weight-loss diets must be investigated [1] [2] [3].

Effects of various weight-loss diets have been proposed and compared. Low

carbohydrate, high-protein diets were compared with very low fat, energy-restricted diets [4] [5] [6] [7].

Recently the carbohydrate-insulin model has been proposed [8]. According to this model, the hormone insulin plays dominant anabolic control. Insulin decreases the circulating major metabolic fuels by stimulating glucose uptake into tissues, inhibiting release of fatty acids from adipose tissue, so that ketones are produced in the liver, and promoting fat and glycogen deposition. Consistent with these effects, increased insulin actions (such as insulin-producing tumors, initiation of insulin treatment of type 2 diabetes or overtreatment of type 1 diabetes) are shown to be associated with weight gain. Interestingly, inadequate insulin treatment of type 1 diabetes and drugs that inhibit insulin secretion causes weight loss.

Dietary carbohydrate has the most potent effects, which vary by amount and type. Most refined grains, potato products and added sugars digest quickly and have a relatively high GI (glycemic index), whereas non-starchy vegetables, legumes, whole fruits and intact whole grains tend to have a moderate or low GI.

The Mediterranean diet was rich in vegetables and low in red meat, with poultry and fish replacing beef and lamb. Mediterranean and low-carbohydrate diets were shown to be effective alternatives to the low-fat diet for weight loss and appear to be just as safe as the low-fat diet [9].

As stated later, the rate of obese people is very low, in fact, one of OECD countries with the lowest obesity rate [10]. We have previously reported correlations between various foods intakes, plasma levels of amino acids or fatty acids in Japanese young and old men and women [11] [12] [13] [14]. So it may be interesting to know what kinds of foods old Japanese men and women are taking and whether any kind of foods intake influences body mass index.

In the present article, we report various foods intakes and their relationships to BMI in old Japanese men and women.

2. Method

We asked male and female acquaintances older than 50 years old. Acquaintances mean that these participants are personal friends of our group members. The sample sizes and ages of participants are as follows. Acquaintances are older than 50 years old; men (n = 44, age; 70.07 ± 11.1) and women (n = 39, age; 67.4 ± 7.5). We did not ask premenopausal women to participate since data may be variable due to their hormonal influences so that sample sizes must be big to get statistically significant results. Dr. K. Matsuoka and K. Kato, who are internists, checked their health carefully and examined their blood samples then recruited them if there were no health problems such as diabetes, hypertension or not serious diseases experienced in the past. They did not smoke in the past. We also excluded people who took drugs for dysli-

pidemia, hyperglycemia, or hypertension. We collected blood samples early morning. Healthy participants were given self-administered diet history questionnaires and described answers on each item by recollection of diets they took (7 days dietary recall). We used a brief-type self-administered diet history questionnaire (BDHQ) by using which the Japanese Ministry of Health, Labour and Welfare reports national Nutrition Surveys. From these questionnaires, we calculated the intakes of energy, carbohydrate, fat, protein or other foods.

Statistics

The results are presented as means ± SEM. Statistical significance of the differences between groups was calculated according to one-way ANOVA. When ANOVA indicated a significant difference ($p < 0.05$), the mean values were compared using Tukey's least significant difference test at $p < 0.05$. Spearman's correlation tests were used to examine statistical significance.

3. Results

Table 1 shows that height, weight and BMI (body mass index) are larger in men than women.

Table 2 shows the amounts of foods intakes of men and women.

The amounts of energy intake are larger in men than women. The amounts of intakes of protein, carbohydrate, lipid fatty acids or other foods are not different between men and women.

The amounts of intakes of alcohol, salt, sucrose, beans, beverages and seasonings are higher in men than women. Since people take salty cakes, beans when they take alcohol or beverages such as Sake in Japan, such habits influence men's foods intakes.

Table 3 shows a correlation between foods and BMI. There is no correlation between any food intake and BMI in women. There are correlations between intakes of vegetable lipid, n − 6 fatty acid, fruits and eggs and BMI in men.

Figure 1 shows Scatter plots and regression line between intakes of carbohydrate and BMI in men and women.

Figures 1-3 show there is no correlation between intakes of carbohydrate, lipid and protein and BMI.

Table 1. Basic characteristics of participants.

		Old men n = 44	Old women n = 39	Significance
Age		70.7 ± 11.1	67.4 ± 7.5	
Height	cm	166.5 ± 6.6	157.1 ± 5.8	**
Weight	kg	67.4 ± 11.1	50.6 ± 6.8	**
BMI	kg/m^2	24.3 ± 3.3	20.5 ± 2.5	**

**p < 0.01 (old men vs. old women).

Table 2. The amounts of various foods intakes.

Foods intakes of men and women		Old men n = 44	Old women n = 39	Significance
Foods	Per day			
Energy	kcal/d	2265 ± 621	1941 ± 535	*
Protein	g/d	86.2 ± 27.7	80.0 ± 27.3	
Animal protein	g/d	51.8 ± 22.0	47.4 ± 19.8	
Vegetable protein	g/d	34.4 ± 9.9	32.6 ± 10.9	
Lipid	g/d	66.4 ± 20.6	60.9 ± 20.9	
Animal lipid	g/d	32.2 ± 13.4	29.0 ± 10.7	
Vegetable lipid	g/d	34.2 ± 9.9	31.9 ± 11.9	
Carbohydrate	g/d	276.0 ± 89.4	248.2 ± 76.9	
Saturated aftty acid	g/d	17.7 ± 6.5	16.3 ± 5.6	
Monosaturated fatty acid	g/d	24.2 ± 7.6	21.6 ± 7.7	
Polysaturated fatty acid	g/d	15.6 ± 4.7	14.6 ± 5.3	
Cholesterol	mg/d	469.9 ± 183.2	440.4 ± 187.9	
Soluble dietary fiber	g/d	3.8 ± 1.4	4.0 ± 1.5	
Insoluble dietary fiber	g/d	11.2 ± 4.9	11.0 ± 4.1	
Total dietary fiber	g/d	15.5 ± 5.7	15.3 ± 5.7	
Salt	g/d	13.9 ± 4.2	11.5 ± 3.2	**
Sugar	g/d	17.8 ± 10.9	15.1 ± 8.5	
Alcohol	g/d	28.0 ± 28.6	9.7 ± 16.5	**
n − 3 fatty acid	g/d	3.4 ± 1.3	3.1 ± 1.4	
n − 6 fatty acid	g/d	12.2 ± 3.6	11.4 ± 4.0	
Grains	g/d	412.1 ± 165.8	338.6 ± 171.6	
Potatoes	g/d	63.4 ± 46.1	53.2 ± 41.3	
Sucrose	g/d	7.5 ± 5.8	5.1 ± 2.9	*
Beans	g/d	59.0 ± 43.2	82.5 ± 59.3	*
Green and yellow vegetables	g/d	148.0 ± 91.1	145.4 ± 75.7	
Other vegetables	g/d	222.9 ± 106.7	220.1 ± 117.5	
Fruits	g/d	159.1 ± 156.1	212.8 ± 115.9	
Fish	g/d	106.4 ± 63.6	94.0 ± 61.7	
Eggs	g/d	45.3 ± 31.9	41.9 ± 27.1	
Milk	g/d	154.3 ± 125.1	169.7 ± 105.1	
Oils	g/d	12.8 ± 5.6	11.1 ± 5.8	
Cookies	g/d	57.7 ± 45.1	62.1 ± 43.1	
Beverages	g/d	1043.9 ± 418.2	779.7 ± 429.9	**
Seasonings, spices	g/d	296.5 ± 163.9	222.0 ± 140.7	*

$**p < 0.01$, $*p < 0.05$.

Table 3. Correlations between various foods intakes and BMI.

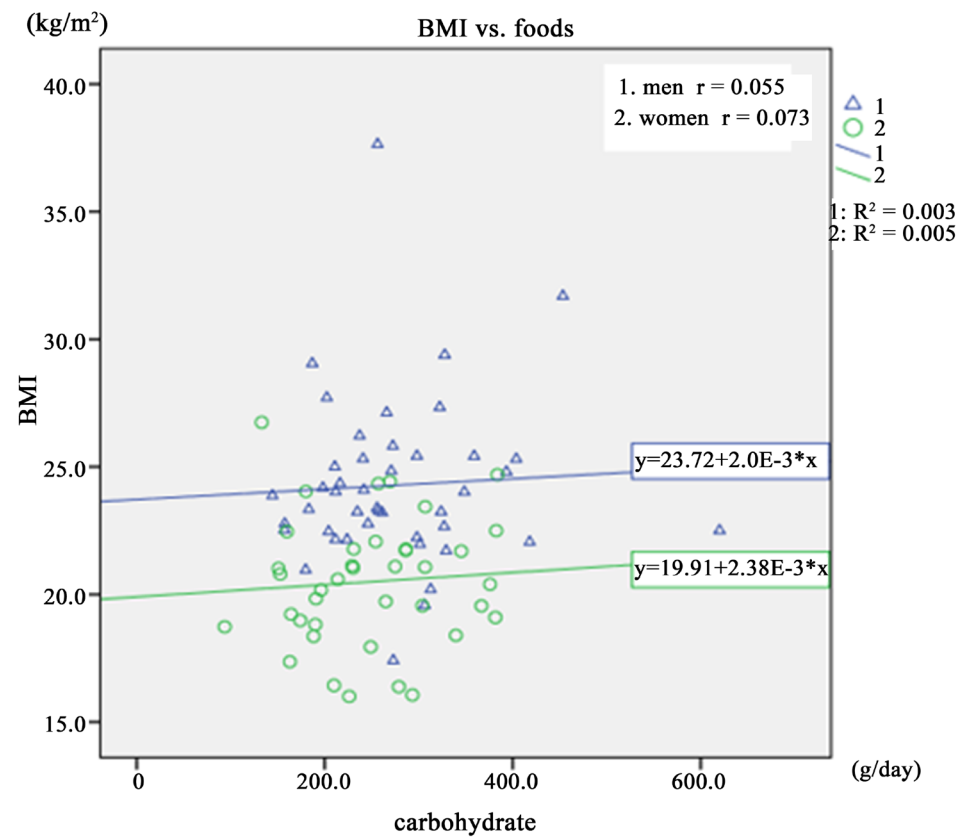|	Correlations	
BMI vs. foods	Old men n = 44	Old women n = 39
Energy	0.072	0.125
Protein	0.050	0.158
Animal protein	0.000	0.125
Vegetable protein	0.144	0.168
Lipid	0.220	0.157
Animal lipid	0.091	0.066
Vegetable lipid	0.335*	0.216
Carbohydrate	0.055	0.073
Saturated fatty acid	0.108	0.145
Monounsaturated fatty acid	0.279	0.152
Polyunsaturated fatty acid	0.255	0.190
Cholesterol	0.228	−0.009
Soluble dietary fiber	0.204	0.080
Insoluble dietary fiber	0.222	0.161
Total dietary fiber	0.236	0.136
Salt	0.103	0.203
Sucrose	0.031	0.022
Alcohol	−0.084	−0.024
n − 3 fatty acid	0.102	0.196
n − 6 fatty acid	0.298*	0.181
Grains	−0.052	−0.009
Potatoes	−0.030	−0.047
Sucrose	−0.237	−0.037
Beans	−0.061	0.289
Green yellow vegetables	0.174	0.095
Other vegetables	0.230	0.248
Fruits	0.298*	−0.047
Fish	−0.095	0.105
Meats	0.142	0.125
Eggs	0.367*	−0.260
Milk	−0.255	0.082
Oil	0.257	0.258
Cakes	0.203	0.068
Beverages	−0.009	0.130
Seasonings, spices	0.012	0.023

*$p < 0.05$.

Figure 1. Scatter plots and regression lines of BMI vs. carbohydrate.
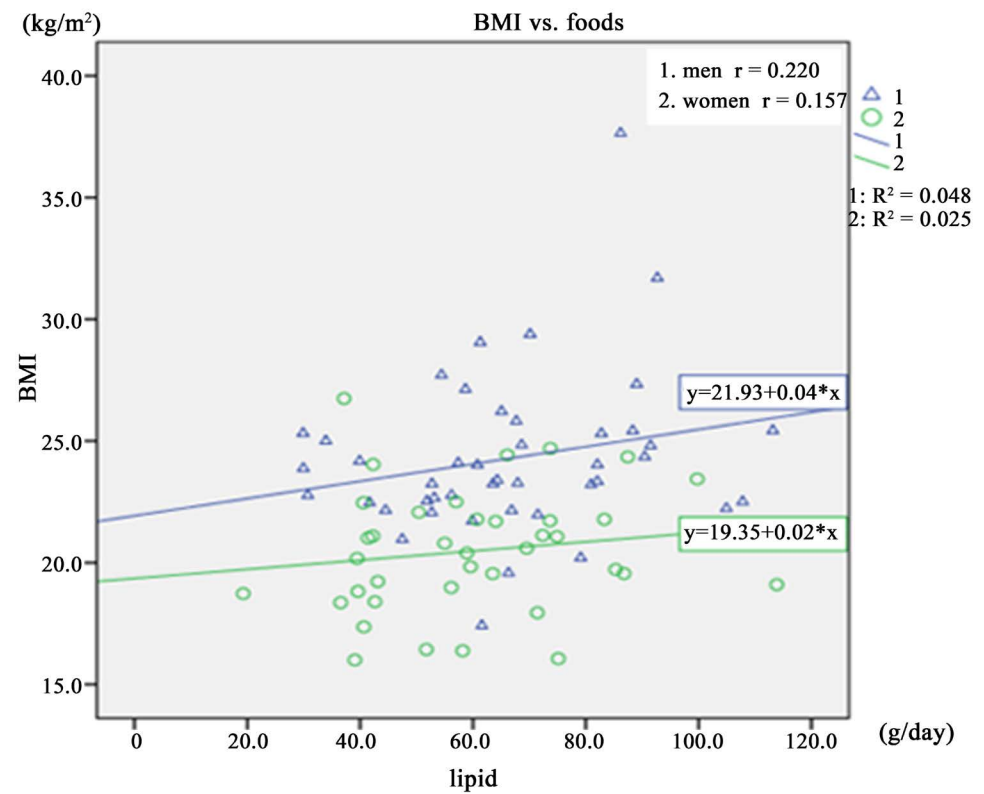

Figure 2. Scatter plots and regression lines between intakes of lipid and BMI.
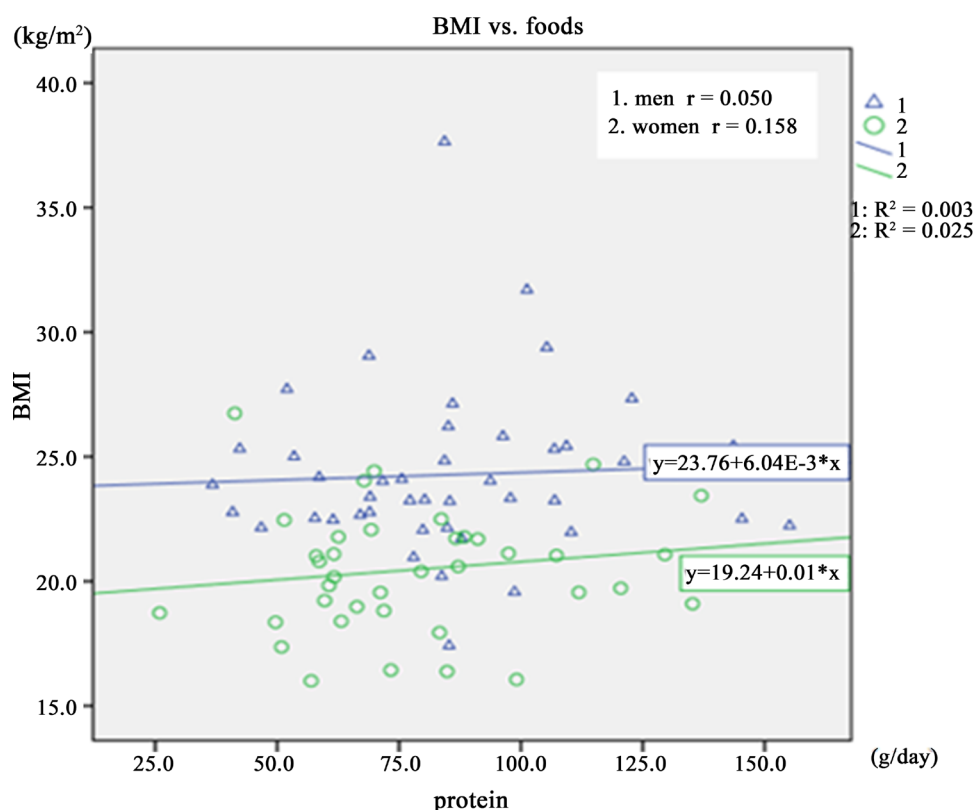
Figure 3. Scatter plots and regression lines between intakes of protein and BMI.

4. Discussion

It has been recognized that a global epidemic of obesity is a threat of health and functional independence of future cohorts of older adults. The obesity and age-related elevation of metabolic risks contribute physical limitation and chronic cardiometabolic disorders.

There have been many diet plans proposed to reduce body weights.

Low-carbohydrate, high-protein, high-fat diets, so called low-carbohydrate diet, have been compared with low fat energy-restricted diets [4] [5] [6] [7].

Mediterranean diet with a moderate amount of fat and a high proportion of monosaturated fat has been shown a benefit for cardiovascular diseases [9] [14] [15].

Recently, carbohydrate insulin model has been proposed [8]. According to a conventional model, overeating results in increase energy intake, which increases levels of circulating metabolic fuels such as glucose or lipids, resulting in fat storage.

According to a carbohydrate insulin model, dietary carbohydrates or other dietary and non-dietary exposure result in increased secretion of insulin. Since insulin increase uptake of glucose into adipose tissues, fat is stored. These changes cause circulating metabolic fuels. These changes cause fat deposit and obesity.

It is now well known that obesity rates are different among countries. In high-income countries, obesity rate (body mass index greater than or equal to 30

kg/m²) is highest among the poor, while overweight (body mass index greater than or equal to 25 kg/m²) is shown across all wealth groups. In contrast, in low-income countries, the prevalence of overweight and obesity is higher among rich people than among poorer people [16].

Since 1975, the prevalence of overweight (body mass index (BMI) greater than or equal to 25 kg/m²) among adults increased from 21.5% to 38.9% in 2016 [17]. Over this period, no country has shown decline in the prevalence of overweight or obesity [18]. In 2000, the World Health Organization declared obesity a pandemic and 12 years later issued a global action plan to combat its rise [19] [20]. The rapid increase in overweight and no availability of population-level control measures are considered to be important reasons of the rising disease burden and mortality from cardiovascular disease, cancer, and diabetes. Overweight and obesity do not display a consistent wealth gradient across different levels of economic development. In most low- and middle-income countries, the prevalence of overweight and obesity is higher among wealthier individuals than among poorer. However, as national economic levels increase, the burden of overweight and obesity shifts to populations with lower personal wealth [21] [22] [23].

Japan is one of the most affluent countries in the world. According to many proposal that people in the affluent countries are obese because they eat so called junk foods often.

As shown in **Figure 4**, men and women in Japan are the leanest in the world. People in other affluent countries such as USA are far more obese than Japanese.

In the present research, we asked healthy Japanese old men and women to report their food intakes. As shown in **Table 3** and **Figures 1-3**, BMI levels did not change upon changes of intakes of carbohydrate, lipid and protein. These
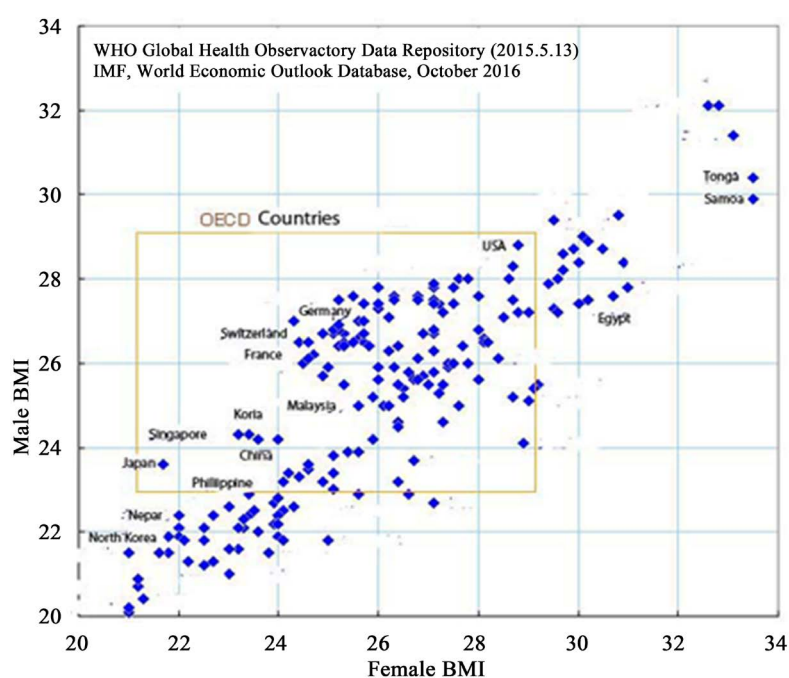

Figure 4. BMI of people in different countries.

results suggest that within the range of intakes of foods n Japan, any kinds of foods led to obesity or slimness.

It is very difficult to explain the reason why such results are obtained. Probably Japanese are very, very health concerned and try to pay much attention to foods.

Finally, some eating habits typical in Japan are discussed. Japanese tend to avoid to eat anything sweat. People think that sweat foods contain sucrose, which has been reported repeatedly unhealthy. There is o custom to eat desserts such as pie after the meal. People prefer to drink black coffee and many beverages are advertised to be sugar free. Even beer or soft drinks are advertised to be sugar free.

Japanese people are very health concerned. People often measure body weights and try to keep slender.

Recently, eating meat or foods of low carbohydrate are considered to be healthy and do not increase body weight.

People also try to be slender by increase exercise such as running, swimming, or oriental ways of exercise such as yoga.

All together Japanese ways of living seem good for weight control, thus keeping lean.

5. Conclusion

Foods intakes and correlations between BMI (body mass index) and various foods intakes in old Japanese men and women were examined. Changes in the amounts of various foods intakes such as carbohydrates, protein, and lipid did not affect BMI.

Ethics

This work has been approved by the Ethical committees of Showa Women's University and NPO (non-profit organization) "International projects on food and health" and has been carried out in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments.

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Conflicts of Interest

Since no profit is obtained by the present research, there are no conflicts of interest, thus no conflicts of interest for any author.

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