

SERUM COMPONENTS AND LIFESTYLE FACTORS - I

Associations of Food and Nutrient Intakes with Serum IGF-I, IGF-II, IGFBP-3, TGF- β 1, Total SOD Activity and sFas Levels among Middle-aged Japanese: the JACC Study

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Abstract

No observational study has examined whether cancer-related biomarkers are associated with diet in Japanese. We therefore assessed sex-specific food and nutrient intakes according to serum IGF-I, IGF-II, IGFBP-3, TGF- β 1, total SOD activity and sFas levels, under a cross-sectional study of 10,350 control subjects who answered the food frequency questionnaire in the first-wave nested case-control study within the Japan Collaborative Cohort Study. For both men and women, IGF-I levels were associated with higher intakes of milk, fruits, green tea, calcium and vitamin C. IGF-II levels were associated with higher intakes of milk, yogurt, fruits and miso soup, and lower intakes of rice, coffee and carbohydrate. IGFBP-3 levels were associated with higher intakes of milk, yogurt, fruits and vitamin C, and lower intakes of rice, energy, protein, carbohydrate, sodium and polyunsaturated fatty acids. TGF- β 1 levels were associated with lower intakes of coffee intakes, and higher intakes of miso soup and sodium. Total SOD activity levels were associated with lower intakes of most nutrients other than energy, carbohydrate, iron, copper, manganese, retinol equivalents, vitamin A, B2, B12, niacin, folic acid, vitamin C and fish fat. sFas levels were associated with higher intakes of manganese and folic acids. The results of the present study should help to account for findings on those biomarkers regarding risks of cancer and other lifestyle-related diseases in terms of dietary confounding as causality.

Keywords: IGF-I/II - IGFBP-3 - TGF- β 1 - SOD activity - sFas levels - food and nutrient intake

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Introduction

The Japan Collaborative Cohort (JACC) Study which is one of the large-scale population-based cohort studies in Japan aimed to reveal risk factors and to provide cancer prevention strategy. Recently, cancer prevention research has focused on biomarkers. Therefore, the first-wave nested case-control study within the JACC Study aimed to investigate the relationships of some specific biomarkers with risk of cancer among Japanese using stored serum samples at baseline survey. This nested case-control study have already shown the relationship between risks of cancer or cancer of specific sites and serum levels of insulin growth factor (IGF)-I, IGF-II, IGF-binding protein 3

(IGFBP-3), transforming growth factor (TGF)- β 1, total superoxide dismutase (SOD) activity or soluble Fas (sFas) (Wakai et al., 2002; Lin et al., 2004; Yatsuya et al., 2005a; Yatsuya et al., 2005b; Lin et al., 2006; Pham et al., 2007a; Pham et al., 2007b; Tamakoshi et al., 2008; Lin et al., 2009).

The Nurses' Health Study, the European Prospective Investigation into Cancer and Nutrition (EPIC) study and other several observational studies of Western populations indicated that associations between these cancer-related biomarkers, particularly IGF-I and IGFBP-3, and diet (Devine et al., 1998; Holmes et al., 2002; Giovannucci et al., 2003; Gunnell et al., 2003; DeLellis et al., 2004; Larsson et al., 2005; Morimoto et al., 2005; McGreevy

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et al., 2007; Norat et al., 2007; Crowe et al., 2009). However, few observational studies has examined whether these biomarkers are associated with diet in Japanese populations.

Therefore, the objective in the present study was to examine food and nutrient intakes according to IGF-I, IGF-II, IGFBP-3, TGF- β 1, total SOD activity and sFas levels.

Materials and Methods

Subjects and setting

The JACC Study began in 1988-90 when 110,792 individuals, 46,465 men and 64,327 women aged 40-79 years living in 45 communities across Japan, took part in municipal health screening examinations and completed a self-administered questionnaire about their lifestyle and medical history. Details of this cohort design and methods were elsewhere (Ohno et al., 2001; Tamakoshi A et al., 2005).

The 39,242 participants from 110,792 participants were collected peripheral blood samples between 1988 and 1990. The collected blood samples were stored in deep freezers at -80°C until 1999. Previously, details of these samples measurements were described elsewhere (Ito Y et al., 2005).

In this study, we conducted a cross-sectional investigation and used 10,350 control subjects with answering the food frequency questionnaire (FFQ) except for sFas levels, since sFas values were systematically low in one area. Therefore, we excluded all sFas data in that area from the analysis. Table 1 shows the number of subjects and means of age according to quartiles of cancer-related biomarker levels for both men and women. The study design and use of serum were approved by the

Ethical Board at the Nagoya University School of Medicine.

Dietary assessment

We used a validated self-administered food frequency questionnaire (FFQ). The components of the FFQ were as follows. Thirty three foods (beef, pork, ham or sausage, chicken, liver, eggs, milk, yogurt, cheese, butter, margarine, deeply-fried foods or tempura, fried vegetables, fresh fish, steamed fish paste, dried fish or salted fish, spinach or garland chrysanthemum, carrots or pumpkins, tomatoes, cabbage or head lettuce, Chinese cabbage, edible wild plants, fungi, potatoes, algae, pickles, preserved foods using soy sauce, boiled beans, tofu, citrus fruits, fruits excluding citrus varieties, fresh fruit juice in summer, and sweets) had a 5-level precoded answer for frequency of intake: 'rarely eat', 'once or twice per month', 'once or twice per week', '3 to 4 times per week', and 'almost daily'. Also, the exact frequency was questioned for six items (miso soup, boiled rice, coffee, tea, green tea, and oolong tea). We also calculated energy and major nutrient intakes estimated by this FFQ (Date C et al., 2005).

Statistical analysis

We calculated the age-adjusted proportions of food frequency and means (standard errors) of nutrient intakes by respective quartiles of IGF-I, IGF-II, IGFBP-3, TGF- β 1, total SOD activity and sFas levels. We tested liner trend of these biomarkers with food and nutrient intakes after adjustment for age by using multiple liner regression analysis. Probability values for statistical tests were 2-tailed and $p < 0.05$ was regarded as statistically significant. The SAS statistical package (version 9.1, SAS) was used for the analyses.

Table 1. Number of Subjects and Mean Values of Age According to Quartiles of Cancer-related Biomarker Levels

	Men				Women			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
IGF-I, ng/ml	≤ 91	91-120	120-160	> 160	≤ 91	91-120	120-160	> 160
No. of subjects	1,037	1,350	1,683	1,315	1,570	1,330	1,244	817
Age, year	65 (7.0)	64 (7.0)	62 (7.4)	61 (8.1)	67 (7.5)	65 (8.0)	61 (8.8)	58 (9.4)
IGF-II, ng/ml	≤ 510	510-580	580-660	> 660	≤ 510	510-580	580-660	> 660
No. of subjects	1,822	1,294	1,228	1,041	1,006	1,108	1,413	1,434
Age, year	65 (7.3)	63 (7.3)	62 (7.5)	61 (7.7)	66 (8.3)	64 (8.9)	63 (9.1)	62 (8.5)
IGFBP-3, $\mu\text{g/ml}$	≤ 2.43	2.43-2.92	2.92-3.46	> 3.46	≤ 2.43	2.43-2.92	2.92-3.46	> 3.46
No. of subjects	1,562	1,454	1,237	1,132	1,036	1,128	1,360	1,437
Age, year	65 (6.9)	63 (7.1)	61 (7.6)	61 (8.0)	67 (7.7)	64 (8.6)	63 (8.9)	61 (8.9)
TGF- β 1, ng/ml	≤ 30.6	30.6-35.9	35.9-41.6	> 41.6	≤ 30.6	30.6-35.9	35.9-41.6	> 41.6
No. of subjects	1,066	1,302	1,411	1,576	1,540	1,301	1,148	965
Age, year	65 (7.2)	64 (7.0)	62 (7.3)	61 (7.8)	65 (8.9)	63 (8.6)	63 (8.6)	63 (9.2)
Total SOD activity, U/ml	≤ 2.3	2.3-2.6	2.6-3.1	> 3.1	≤ 2.3	2.3-2.6	2.6-3.1	> 3.1
No. of subjects	2,156	1,185	998	1,049	1,175	1,051	1,326	1,410
Age, year	62 (7.6)	63 (7.5)	64 (7.3)	63 (7.7)	62 (9.1)	64 (8.7)	64 (8.8)	64 (8.7)
sFAS, ng/ml	≤ 1.8	1.8-2.2	2.2-2.6	> 2.6	≤ 1.8	1.8-2.2	2.2-2.6	> 2.6
No. of subjects	1,147	1,329	1,102	1,276	1,214	1,261	1,000	1,041
Age, year	61 (7.4)	62 (7.8)	63 (7.5)	65 (7.5)	60 (9.7)	62 (8.5)	65 (8.3)	67 (7.6)

Table 2. Sex-specific Age-adjusted Proportions of Higher Frequency of Foods According to Quartiles of Serum IGF-I Levels

ng/ml	Men					Women				
	Q1 ≤91	Q2 91-120	Q3 120-160	Q4 >160	p for trend	Q1 ≤91	Q2 91-120	Q3 120-160	Q4 >160	p for trend
3-4/w and more, %										
Beef	12.3	12.8	10.8	8.3	0.001	16.2	13.3	11.4	9.7	<0.001
Pork (excluding ham/sausage)	26.8	22.6	22.2	24.2	0.26	25.6	22.3	21.7	20.8	0.010
Ham/sausage	18.0	13.6	14.9	13.9	0.04	15.6	12.9	15.0	12.8	0.200
Chicken	25.9	20.4	20.9	21.0	0.02	26.7	24.3	27.0	23.2	0.220
Liver	3.9	5.0	5.1	4.8	0.68	4.9	5.1	5.2	2.7	0.080
Eggs	74.8	72.2	73.5	73.8	0.86	67.7	70.3	73.3	71.2	0.020
Milk	42.2	53.1	59.0	64.0	<0.001	53.8	59.2	66.6	67.9	<0.001
Yogurt	5.0	7.2	6.3	9.9	0.001	11.7	10.9	11.6	14.4	0.140
Cheese	8.2	6.5	7.3	8.5	0.64	7.1	5.0	7.0	7.6	0.620
Butter	10.1	7.0	7.6	8.7	0.45	11.0	9.1	9.6	7.6	0.040
Margarine	14.0	13.3	15.2	15.9	0.17	20.4	21.1	21.1	18.6	0.540
Deep- fried foods/tempura	26.5	28.4	29.1	26.7	0.94	25.9	21.6	24.3	22.5	0.160
Fried vegetables	46.4	45.4	44.2	46.0	0.83	45.6	42.3	44.6	43.5	0.460
Fresh fish	67.0	57.7	59.2	61.1	0.04	60.5	58.1	57.6	62.8	0.600
Kamaboko (fish paste)	13.6	14.6	14.8	13.6	0.81	15.5	18.2	14.8	16.5	0.990
Dried fish/salted fish	32.1	32.6	34.2	34.3	0.23	27.8	30.8	32.4	28.9	0.300
5/w and more, %										
Spinach/garland chrysanthemum	38.9	34.9	35.7	35.3	0.18	36.8	39.1	37.4	37.7	0.760
Carrot/pumpkin	19.7	15.2	15.6	15.6	0.03	25.2	26.3	25.4	28.7	0.160
Tomatoes	17.7	17.4	16.2	18.4	0.73	21.9	22.3	23.9	24.4	0.160
Cabbage or head lettuce	23.6	20.7	21.8	23.1	0.96	31.2	32.2	29.8	32.9	0.690
Chinese cabbage	16.3	17.8	18.1	18.2	0.32	15.7	18.3	20.1	20.6	0.010
Edible wild plants	4.2	3.2	3.2	3.1	0.25	3.9	3.8	3.4	2.6	0.160
Fungi/mushrooms	7.0	7.6	7.0	7.4	0.91	8.7	10.4	7.7	10.7	0.420
Potatoes	21.5	13.9	13.9	16.4	0.01	23.2	17.4	21.4	25.2	0.360
Algae (seaweeds)	33.7	27.2	27.4	29.0	0.05	39.2	36.9	40.2	40.1	0.540
Pickles	64.2	60.5	61.7	62.6	0.68	66.0	64.5	63.6	64.1	0.300
Preserved foods/soy sauce	5.3	7.4	7.4	5.2	0.71	8.0	7.5	7.0	7.5	0.600
Boiled beans	4.1	5.6	5.3	6.3	0.07	5.3	7.7	7.7	8.9	0.010
Tofu (soybean curd)	43.8	32.1	32.9	31.7	<0.001	44.5	35.7	35.5	35.2	<0.001
Citrus fruits	26.5	30.5	27.7	29.7	0.29	38.6	44.5	47.8	48.3	<0.001
Fresh fruit juice (summer)	8.9	16.0	14.3	15.8	<0.001	13.1	15.3	16.3	19.4	0.001
Fruits (excluding citrus)	22.8	25.8	22.1	29.7	<0.001	38.1	40.9	42.7	46.9	<0.001
Sweets	17.9	19.0	18.6	16.8	0.41	26.1	24.5	24.5	20.2	0.010
Coffee	14.6	22.0	18.9	20.7	0.02	23.1	24.8	20.3	22.1	0.300
Tea	0.8	1.3	1.1	0.8	0.78	1.3	2.1	1.5	1.5	0.720
Green tea	59.3	71.2	70.5	68.6	0.01	63.3	68.9	67.7	68.7	0.040
Oolong tea	2.1	3.4	3.3	5.1	0.001	6.7	7.7	7.3	10.9	0.010
3/d and more, %										
Bowls of rice (at present)	82.8	82.7	83.2	77.8	0.002	72.9	74.3	73.2	73.6	0.770
Bowls of rice (at 30 years old)	93.1	92.8	93.2	91.2	0.11	89.0	88.2	87.5	87.9	0.350
Bowls of miso (at present)	42.7	37.0	37.7	36.4	0.01	23.9	22.2	21.8	23.1	0.570
Bowls of miso (at 30 years old)	62.6	53.4	56.3	55.4	0.02	44.4	38.5	43.8	47.8	0.220

Results

Food intakes according to quartiles of IGF-I (Table 2)

For both men and women, persons with higher IGF-I levels had higher proportions of 3 or more servings/week

of milk and of 5 or more serving/week of fresh fruits juice, fruits, green tea and oolong tea, and lower proportions of 3 or more servings/week of beef and of 5 or more servings/week of tofu intake.

Other factors, like bowls of rice at present and yoghurt

Table 3. Sex-specific Age-adjusted Mean and Standard Error of Energy and Nutrient Intakes According to Quartiles of Serum IGF-I Levels

ng/ml	Men					Women				
	Q1 ≤91	Q2 91-120	Q3 120-160	Q4 >160	p for trend	Q1 ≤91	Q2 91-120	Q3 120-160	Q4 >160	p for trend
Energy, kcal	1,810 (20.2)	1,818 (17.7)	1,832 (15.9)	1,765 (17.8)	<0.001	1,455 (12.2)	1,468 (12.8)	1,452 (12.9)	1,457 (15.0)	0.95
Protein, g	59.1 (0.7)	58.9 (0.6)	60.0 (0.5)	59.7 (0.6)	0.34	55.2 (0.5)	55.0 (0.5)	55.6 (0.5)	56.3 (0.6)	0.16
Fat, g	32.3 (0.4)	32.5 (0.4)	33.4 (0.4)	33.6 (0.4)	0.01	32.4 (0.4)	31.8 (0.4)	32.5 (0.4)	32.6 (0.4)	0.57
Carbohydrate, g	270 (3.7)	271 (3.2)	272 (2.9)	261 (3.2)	0.05	229 (2.2)	234 (2.3)	227 (2.3)	228 (2.7)	0.55
Metals, mg										
Sodium	2,409 (38.6)	2,290 (33.8)	2,337 (30.5)	2,398 (34.0)	0.73	2,108 (28.6)	2,019 (29.9)	2,111 (30.1)	2,195 (35.1)	0.04
Potassium	2,274 (29.5)	2,391 (25.8)	2,414 (23.3)	2,457 (25.9)	<0.001	2,313 (23.1)	2,387 (24.1)	2,423 (24.2)	2,497 (28.3)	<0.001
Calcium	480 (7.1)	507 (6.2)	525 (5.6)	544 (6.3)	<0.001	493 (5.7)	508 (5.9)	524 (6.0)	541 (6.9)	<0.001
Magnesium	237 (2.7)	238 (2.4)	241 (2.2)	243 (2.4)	0.04	225 (2.0)	226 (2.1)	229 (2.1)	235 (2.5)	<0.001
Phosphate	917 (10.6)	929 (9.3)	950 (8.4)	954 (9.4)	0.004	875 (8.1)	881 (8.4)	894 (8.5)	910 (9.9)	0.01
Iron, g	7.9 (0.1)	8.1 (0.1)	8.2 (0.1)	8.2 (0.1)	0.02	7.4 (0.1)	7.6 (0.1)	7.7 (0.1)	7.8 (0.1)	<0.001
Zinc	7.9 (0.1)	7.9 (0.1)	8.0 (0.1)	7.8 (0.1)	0.91	7.1 (0.1)	7.1 (0.1)	7.1 (0.1)	7.1 (0.1)	0.74
Copper	1.3 (0.0)	1.3 (0.0)	1.3 (0.0)	1.3 (0.0)	0.61	1.1 (0.0)	1.1 (0.0)	1.1 (0.0)	1.1 (0.0)	0.21
Manganese	5.0 (0.1)	6.5 (0.1)	6.2 (0.1)	6.0 (0.1)	<0.001	4.8 (0.1)	5.7 (0.1)	5.6 (0.1)	5.7 (0.1)	<0.001
Vitamins, mg										
Retinol*, µg	511 (33.8)	610 (29.5)	637 (26.6)	583 (29.7)	0.16	510 (27.4)	563 (28.6)	583 (28.8)	472 (33.6)	0.65
Carotene, µg	3,334 (55.9)	3,134 (48.9)	3,210 (44.1)	3,267 (49.2)	0.78	3,401 (44.6)	3,367 (46.5)	3,429 (46.9)	3,571 (54.7)	0.02
Vitamin A, IU	1,094 (36.3)	1,183 (31.8)	1,218 (28.7)	1,172 (31.9)	0.13	1,107 (29.6)	1,169 (30.8)	1,198 (31.1)	1,111 (36.2)	0.66
Vitamin D	8.5 (0.2)	8.0 (0.1)	8.3 (0.1)	8.2 (0.1)	0.48	8.0 (0.1)	7.9 (0.1)	8.0 (0.1)	8.3 (0.2)	0.15
Vitamin E	5.4 (0.1)	5.2 (0.1)	5.4 (0.1)	5.4 (0.1)	0.49	5.4 (0.1)	5.2 (0.1)	5.4 (0.1)	5.5 (0.1)	0.16
Vitamin K	205 (3.2)	194 (2.8)	198 (2.5)	200 (2.8)	0.57	197 (2.5)	194 (2.6)	198 (2.7)	203 (3.1)	0.14
Vitamin B1	0.77 (0.0)	0.76 (0.0)	0.78 (0.0)	0.79 (0.0)	0.14	0.75 (0.0)	0.75 (0.0)	0.76 (0.0)	0.78 (0.0)	0.05
Vitamin B2	1.13 (0.0)	1.32 (0.0)	1.32 (0.0)	1.33 (0.0)	<0.001	1.18 (0.0)	1.29 (0.0)	1.30 (0.0)	1.31 (0.0)	<0.001
Niacin	13.1 (0.2)	13.6 (0.2)	13.6 (0.1)	13.5 (0.2)	0.18	12.8 (0.1)	13.0 (0.1)	13.0 (0.1)	13.2 (0.2)	0.07
Vitamin B6	1.09 (0.0)	1.09 (0.0)	1.11 (0.0)	1.11 (0.0)	0.10	1.07 (0.0)	1.07 (0.0)	1.09 (0.0)	1.11 (0.0)	0.004
Vitamin B12	8.0 (0.2)	8.1 (0.1)	8.3 (0.1)	8.2 (0.1)	0.30	7.4 (0.1)	7.4 (0.1)	7.7 (0.1)	7.5 (0.2)	0.37
Folic acid	383 (7.1)	443 (6.2)	438 (5.6)	434 (6.3)	<0.001	384 (5.6)	422 (5.9)	427 (5.9)	426 (6.9)	<0.001
Pantothenic acid	5.3 (0.1)	5.5 (0.1)	5.6 (0.1)	5.6 (0.1)	0.001	5.2 (0.1)	5.3 (0.1)	5.4 (0.1)	5.4 (0.1)	0.01
Vitamin C	114 (2.1)	128 (1.8)	126 (1.6)	128 (1.8)	<0.001	123 (1.6)	132 (1.7)	134 (1.7)	139 (2.0)	<0.001
Fat, g										
Saturated	9.1 (0.1)	9.6 (0.1)	9.9 (0.1)	10.1 (0.1)	<0.001	9.6 (0.1)	9.7 (0.1)	9.9 (0.1)	9.9 (0.1)	0.08
Monounsaturated	10.2 (0.2)	10.2 (0.1)	10.4 (0.1)	10.5 (0.1)	0.10	10.3 (0.1)	10.1 (0.1)	10.3 (0.1)	10.2 (0.2)	0.74
Polyunsaturated	8.0 (0.1)	7.6 (0.1)	7.8 (0.1)	7.8 (0.1)	0.90	7.3 (0.1)	7.0 (0.1)	7.2 (0.1)	7.3 (0.1)	0.99
Cholesterol mg	278 (4.6)	275 (4.0)	283 (3.6)	284 (4.0)	0.15	272 (3.8)	269 (3.9)	275 (4.0)	274 (4.6)	0.55
Dietary fiber, g										
Soluble	2.0 (0.0)	1.9 (0.0)	1.9 (0.0)	2.0 (0.0)	0.90	2.0 (0.0)	1.9 (0.0)	2.0 (0.0)	2.1 (0.0)	0.01
Unsoluble	8.3 (0.1)	8.0 (0.1)	8.2 (0.1)	8.2 (0.1)	0.67	7.8 (0.1)	7.7 (0.1)	7.8 (0.1)	8.1 (0.1)	0.03
Total	11.4 (0.2)	10.8 (0.1)	11.1 (0.1)	11.2 (0.1)	0.77	10.9 (0.1)	10.7 (0.1)	10.9 (0.1)	11.3 (0.1)	0.04
Salt, g	6.0 (0.1)	5.7 (0.1)	5.8 (0.1)	6.0 (0.1)	0.77	5.3 (0.1)	5.0 (0.1)	5.3 (0.1)	5.5 (0.1)	0.05
Animal fat, g	14.1 (0.3)	15.1 (0.2)	15.5 (0.2)	15.9 (0.2)	<0.001	15.3 (0.2)	15.5 (0.2)	15.8 (0.2)	15.6 (0.3)	0.25
Fish fat, g	4.7 (0.1)	4.4 (0.1)	4.6 (0.1)	4.5 (0.1)	0.40	4.4 (0.1)	4.3 (0.1)	4.4 (0.1)	4.6 (0.1)	0.23
Vegetable oil, g	13.5 (0.2)	12.9 (0.2)	13.3 (0.2)	13.2 (0.2)	0.75	12.7 (0.2)	12.0 (0.2)	12.3 (0.2)	12.4 (0.2)	0.30

* equivalents

were only significant for men, whereas citrus fruits were only highly significant for women.

Mean energy and nutrient intakes according to quartiles of IGF-I (Table 3)

Persons with higher IGF-I levels had higher mean intakes of potassium, calcium and vitamin B2, C, folic acid and pantothenic acid for both men and women. Men

with higher IGF-I levels had higher mean intakes of total fat and saturated fatty acids. Women with higher IGF-I levels also tended to have higher mean intake of saturated fat.

Frequency of food intakes according to quartiles of IGF-I (Table 4)

For both men and women, persons with higher IGF-I

Table 4. Sex-specific Age-adjusted Proportions of Higher Frequency of Foods According to Quartiles of Serum IGF-II Levels

ng/ml	Men					Women				
	Q1 ≤510	Q2 510-580	Q3 580-660	Q4 >660	p for trend	Q1 ≤510	Q2 510-580	Q3 580-660	Q4 >660	p for trend
3-4/w and more, %										
Beef	14.5	10.7	8.0	8.1	<0.001	15.3	13.7	13.5	10.1	0.001
Pork (excluding ham/sausage)	23.9	25.1	21.4	24.2	0.71	26.1	25.6	21.6	19.9	<0.001
Ham/ausage	16.3	15.4	13.3	13.9	0.05	15.9	14.5	14.3	13.0	0.07
Chicken	23.9	20.5	20.8	20.8	0.06	27.6	25.6	25.1	24.5	0.12
Liver	4.4	5.6	4.6	5.0	0.70	5.4	6.0	4.2	3.6	0.04
Eggs	74.7	73.2	74.0	71.2	0.07	73.0	70.6	70.4	68.3	0.02
Milk	51.5	56.5	58.3	58.3	<0.001	57.7	57.4	61.6	64.9	<0.001
Yogurt	5.8	6.0	8.9	9.8	<0.001	10.6	11.3	12.0	13.2	0.08
Cheese	8.0	6.2	7.5	8.7	0.52	7.1	5.9	6.9	6.6	0.97
Butter	8.7	7.8	8.5	7.8	0.60	9.8	9.8	9.8	9.0	0.57
Margarine	12.9	14.6	15.0	16.9	0.02	20.2	20.3	20.6	20.5	0.90
Deep- fried foods/tempura	29.4	28.5	25.9	26.5	0.09	24.0	25.0	23.6	23.2	0.52
Fried vegetables	45.0	46.6	44.3	45.9	0.87	43.1	42.4	44.3	45.9	0.14
Fresh fish	59.0	61.6	61.2	62.5	0.08	57.0	59.9	59.2	61.2	0.07
Kamaboko (fish paste)	16.1	12.7	12.1	16.0	0.63	18.1	16.8	15.8	15.2	0.13
Dried fish/salted fish	33.5	32.3	34.2	33.8	0.72	29.0	31.5	29.2	30.1	0.89
5/w and more, %										
Spinach/garland chrysanthemum										
	34.6	38.6	35.2	36.3	0.62	38.0	37.7	37.7	37.5	0.85
Carrot/pumpkin	15.1	15.7	17.3	17.8	0.05	26.3	26.2	26.9	25.2	0.57
Tomatoes	17.0	16.8	17.3	18.7	0.30	22.3	20.5	24.3	23.8	0.16
Cabbage/head lettuce	19.4	21.1	24.8	25.1	<0.001	32.5	28.8	32.4	31.7	0.81
Chinese cabbage	17.3	16.4	17.9	19.6	0.16	16.3	19.3	17.9	19.2	0.24
Edible wild plants	4.0	3.3	2.8	3.2	0.23	4.4	3.7	2.7	3.6	0.41
Fungi (enokidake/shiitake)	6.9	6.7	8.1	7.6	0.36	8.4	10.0	8.7	9.8	0.50
Potatoes	14.6	13.9	17.2	19.6	0.00	21.6	21.4	21.6	21.5	1.00
Algae (seaweeds)	28.4	29.0	28.9	29.8	0.48	38.8	38.2	39.7	39.0	0.82
Pickles	64.2	60.8	61.2	61.1	<0.001	68.9	65.5	64.8	61.1	<0.001
Preserved foods/soy sauce	6.9	6.6	5.4	6.7	0.58	9.0	7.1	8.2	6.2	0.04
Boiled beans	5.8	5.3	4.4	5.8	0.73	7.0	7.2	7.4	7.0	0.97
Tofu (soybean curd)	34.3	34.2	35.4	34.5	0.78	40.5	37.6	37.9	37.8	0.29
Citrus fruits	31.2	27.2	29.0	25.6	0.01	45.1	44.5	43.8	43.4	0.43
Fresh fruits juice (summer)	13.4	13.2	14.8	14.6	0.33	14.7	14.3	14.6	18.0	0.03
Fruits (excluding citrus)	21.5	23.2	28.4	29.1	<0.001	37.5	40.3	45.3	41.4	0.06
Sweets	21.5	20.3	16.2	11.8	<0.001	28.4	26.7	24.8	18.9	<0.001
Coffee	20.9	21.4	17.5	15.4	<0.001	25.6	23.6	22.7	20.1	0.00
Tea	0.7	1.4	1.0	1.0	0.66	1.3	1.7	1.5	1.8	0.57
Green tea	69.5	70.9	68.6	64.2	0.02	68.2	68.9	66.7	65.3	0.12
Oolong tea	2.7	4.0	3.5	4.2	0.113	7.0	7.0	8.4	8.4	0.21
3/d and more, %										
Bowls of rice (at present)	83.6	81.9	81.1	78.9	0.002	74.8	75.0	74.1	70.7	<0.001
Bowls of rice (at 30 years old)	92.4	92.4	92.7	93.2	0.45	87.6	88.1	88.8	88.2	0.66
Bowls of miso (at present)	34.3	38.0	41.5	41.4	<0.001	18.6	23.4	22.3	25.8	0.002
Bowls of miso (at 30 years old)	52.0	56.9	59.9	60.6	<0.001	36.0	43.1	43.2	48.9	<0.001

II levels had higher proportions of 3 or more servings/week of milk intakes and of 3 or more bowls/day of miso soup intake (both at present and 30 years old), and lower proportions of 3 or more servings/week of beef and eggs intakes, of 5 or more serving/week of sweets and coffee

intakes and of 3 or more bowls of rice intake at present.

Mean energy and nutrient intakes according to quartiles of IGF-II (Table 5)

Persons with higher IGF-II levels had lower mean

Table 5. Sex-specific Age-adjusted Mean and Standard Error of Energy and Nutrient Intakes According to Quartiles of Serum IGF-II Levels

ng/ml	Men					Women				
	Q1 ≤510	Q2 510-580	Q3 580-660	Q4 >660	p for trend	Q1 ≤510	Q2 510-580	Q3 580-660	Q4 >660	p for trend
Energy, kcal	1,795 (16.2)	1,841 (18.1)	1,798 (17.9)	1,798 (19.1)	0.81	1,495 (15.7)	1,462 (13.9)	1,459 (11.8)	1,435 (11.4)	0.003
Protein, g	59.1 (0.6)	60.5 (0.6)	59.0 (0.6)	59.3 (0.7)	0.92	56.3 (0.7)	55.4 (0.6)	55.2 (0.5)	55.3 (0.5)	0.32
Fat, g	32.9 (0.4)	33.6 (0.4)	32.7 (0.4)	32.8 (0.4)	0.67	32.8 (0.5)	32.1 (0.4)	32.2 (0.4)	32.3 (0.3)	0.57
Carbohydrate, g	270 (2.9)	274 (3.3)	267 (3.3)	261 (3.5)	0.03	237 (2.8)	231 (2.5)	231 (2.1)	224 (2.1)	<0.001
Metals, mg										
Sodium	23.1 (3.1)	23.9 (34.7)	23.4 (34.3)	23.9 (36.6)	0.19	20.9 (37.0)	21.0 (32.6)	21.0 (27.8)	21.1 (26.8)	0.68
Potassium	23.6 (2.4)	24.4 (26.6)	23.8 (26.3)	24.0 (28.0)	0.45	23.8 (29.8)	23.8 (26.3)	24.1 (22.4)	24.0 (21.6)	0.51
Calcium	504 (5.8)	529 (6.5)	518 (6.4)	519 (6.8)	0.15	507 (7.3)	503 (6.5)	516 (5.5)	523 (5.3)	0.02
Magnesium	238 (2.2)	245 (2.5)	239 (2.4)	240 (2.6)	0.79	229 (2.6)	228 (2.3)	229 (2.0)	228 (1.9)	0.82
Phosphate	931 (8.5)	958 (9.6)	934 (9.5)	937 (10.1)	0.94	896 (10.4)	883 (9.2)	887 (7.9)	889 (7.6)	0.83
Iron, g	8.0 (0.1)	8.3 (0.1)	8.1 (0.1)	8.1 (0.1)	0.67	7.7 (0.1)	7.6 (0.1)	7.6 (0.1)	7.6 (0.1)	0.65
Zinc	7.9 (0.1)	8.1 (0.1)	7.9 (0.1)	7.8 (0.1)	0.19	7.3 (0.1)	7.1 (0.1)	7.1 (0.1)	7.0 (0.1)	0.01
Copper	1.3 (0.0)	1.3 (0.0)	1.3 (0.0)	1.3 (0.0)	0.47	1.2 (0.0)	1.1 (0.0)	1.1 (0.0)	1.1 (0.0)	0.04
Manganese	5.9 (0.1)	6.3 (0.1)	6.0 (0.1)	5.8 (0.1)	0.26	5.4 (0.1)	5.5 (0.1)	5.5 (0.1)	5.3 (0.1)	0.65
Vitamins, mg										
Retinol*, µg	581 (2.7)	627 (30.3)	590 (30.0)	574 (32.0)	0.76	574 (35.4)	536 (31.2)	528 (26.6)	519 (25.6)	0.25
Carotene, µg	316 (4.5)	328 (50.2)	320 (9.7)	331 (53.0)	0.07	341 (57.5)	336 (50.8)	346 (43.2)	346 (41.6)	0.25
Vitamin A, IU	11.5 (2.9)	12.2 (32.6)	11.7 (32.3)	11.7 (34.4)	0.89	11.8 (38.1)	11.4 (33.6)	11.5 (28.7)	11.4 (27.6)	0.44
Vitamin D	8.1 (0.1)	8.3 (0.1)	8.0 (0.1)	8.5 (0.2)	0.15	8.0 (0.2)	8.1 (0.1)	7.9 (0.1)	8.2 (0.1)	0.44
Vitamin E	5.3 (0.1)	5.4 (0.1)	5.3 (0.1)	5.4 (0.1)	0.26	5.4 (0.1)	5.3 (0.1)	5.4 (0.1)	5.4 (0.1)	0.41
Vitamin K	196 (2.6)	203 (2.9)	195 (2.9)	202 (3.1)	0.30	198 (3.3)	195 (2.9)	199 (2.5)	198 (2.4)	0.65
Vitamin B1	0.8 (0.0)	0.8 (0.0)	0.8 (0.0)	0.8 (0.0)	0.59	0.8 (0.0)	0.8 (0.0)	0.76 (0.0)	0.75 (0.0)	0.36
Vitamin B2	1.3 (0.0)	1.3 (0.0)	1.3 (0.0)	1.27 (0.0)	0.88	1.3 (0.0)	1.3 (0.0)	1.27 (0.0)	1.27 (0.0)	0.77
Niacin	13.5 (0.1)	13.8 (0.2)	13.3 (0.2)	13.4 (0.2)	0.41	13.1 (0.2)	13.1 (0.2)	12.9 (0.1)	12.9 (0.1)	0.34
Vitamin B6	1.1 (0.0)	1.1 (0.0)	1.1 (0.0)	1.11 (0.0)	0.24	1.09 (0.0)	1.08 (0.0)	1.08 (0.0)	1.09 (0.0)	0.95
Vitamin B12	8.0 (0.1)	8.4 (0.2)	8.1 (0.2)	8.3 (0.2)	0.29	7.6 (0.2)	7.6 (0.1)	7.4 (0.1)	7.6 (0.1)	0.93
Folic acid	420 (5.7)	442 (6.4)	426 (6.4)	424 (6.8)	0.90	412 (7.3)	412 (6.4)	415 (5.5)	411 (5.3)	0.92
Pantothenic A	5.5 (0.1)	5.7 (0.1)	5.5 (0.1)	5.5 (0.1)	0.83	5.4 (0.1)	5.3 (0.1)	5.3 (0.0)	5.3 (0.0)	0.38
Vitamin C	12.2 (1.7)	12.7 (1.9)	12.5 (1.8)	12.6 (2.0)	0.24	13.0 (2.1)	13.0 (1.9)	13.2 (1.6)	13.2 (1.5)	0.31
Fats, g										
Saturated	9.7 (0.1)	9.9 (0.1)	9.6 (0.1)	9.6 (0.1)	0.42	9.9 (0.2)	9.6 (0.1)	9.8 (0.1)	9.8 (0.1)	0.84
Monounsaturated	10.4 (0.1)	10.5 (0.1)	10.2 (0.1)	10.3 (0.1)	0.42	10.4 (0.2)	10.1 (0.1)	10.2 (0.1)	10.2 (0.1)	0.27
Polyunsaturated	7.7 (0.1)	7.9 (0.1)	7.8 (0.1)	7.8 (0.1)	0.53	7.3 (0.1)	7.2 (0.1)	7.2 (0.1)	7.3 (0.1)	0.92
Cholesterol, mg	280 (3.7)	284 (4.1)	279 (4.1)	279 (4.4)	0.67	284 (4.8)	270 (4.3)	270 (3.6)	270 (3.5)	0.04
Dietary fiber, g										
Soluble	1.9 (0.0)	1.9 (0.0)	1.9 (0.0)	2.0 (0.0)	0.07	2.0 (0.0)	2.0 (0.0)	2.0 (0.0)	2.0 (0.0)	0.45
Unsoluble	8.1 (0.1)	8.3 (0.1)	8.2 (0.1)	8.2 (0.1)	0.32	7.8 (0.1)	7.8 (0.1)	7.9 (0.1)	7.8 (0.1)	0.95
Total	11.0 (0.1)	11.2 (0.1)	11.1 (0.1)	11.2 (0.1)	0.19	10.9 (0.2)	10.9 (0.1)	11.0 (0.1)	10.9 (0.1)	0.94
Salt, g	5.8 (0.1)	6.0 (0.1)	5.9 (0.1)	6.0 (0.1)	0.19	5.2 (0.1)	5.3 (0.1)	5.2 (0.1)	5.3 (0.1)	0.68
Animal fat, g	15.3 (0.2)	15.6 (0.2)	15.1 (0.2)	14.9 (0.3)	0.18	16.1 (0.3)	15.2 (0.3)	15.6 (0.2)	15.4 (0.2)	0.24
Fish fat, g	4.5 (0.1)	4.6 (0.1)	4.4 (0.1)	4.8 (0.1)	0.08	4.3 (0.1)	4.5 (0.1)	4.3 (0.1)	4.5 (0.1)	0.24
Vegetable oil, g	13.1 (0.2)	13.4 (0.2)	13.2 (0.2)	13.2 (0.2)	0.96	12.4 (0.2)	12.4 (0.2)	12.4 (0.1)	12.3 (0.1)	0.81

* equivalents

intake of carbohydrate for both men and women.

Frequency of food intakes according to quartiles of IGFBP-3 (Table 6)

For both men and women, persons with higher IGFBP-3 levels had higher proportions of 3 or more servings/week of milk, yogurt, margarine intakes and of 5 or more serving/week of fruits and oolong tea intakes, and lower

proportions of 3 or more servings/week of beef, deep-fried foods or tempura and fried vegetables intakes, of 5 or more serving/week of pickles, tofu and sweets intakes and of 3 or more bowls of rice intake at present.

Mean energy and nutrient intakes according to quartiles of IGFBP-3 (Table 7)

For both men and women, persons with higher IGFBP-

Table 6. Sex-specific Age-adjusted Proportions of Higher Frequency of Foods According to Quartiles of Serum IGFBP-3 Levels

$\mu\text{g/ml}$	Men					Women				
	Q1 ≤ 2.43	Q2 2.43-2.92	Q3 2.92-3.46	Q4 >3.46	p for trend	Q1 ≤ 2.43	Q2 2.43-2.92	Q3 2.92-3.46	Q4 >3.46	p for trend
3-4/w and more, %										
Beef	13.9	11.8	9.2	7.6	<0.001	15.9	13.4	11.7	11.9	0.016
Pork (excluding ham/sausage)	25.2	23.3	23.1	22.5	0.14	27.3	24.9	21.5	19.5	<0.001
Ham/sausage	16.3	15.4	12.3	15.4	0.24	18.0	15.2	12.2	12.7	0.001
Chicken	24.4	20.3	21.6	20.1	0.03	27.2	25.8	26.2	23.5	0.06
Liver	4.9	4.9	5.4	4.1	0.52	6.0	5.8	4.2	3.4	0.01
Eggs	74.6	74.2	72.1	72.6	0.17	71.7	70.6	68.7	70.8	0.61
Milk	50.8	52.5	59.2	62.1	<0.001	53.9	58.1	59.9	68.9	<0.001
Yogurt	6.4	6.3	6.6	10.7	0.001	10.9	9.8	11.4	14.8	0.004
Cheese	7.7	6.8	6.2	9.9	0.13	6.8	6.2	5.4	8.0	0.29
Butter	9.4	6.5	8.3	9.0	0.93	9.6	9.6	9.4	9.6	0.97
Margarine	12.8	12.6	15.6	18.5	<0.001	18.9	18.1	19.0	24.2	0.002
Deep-fried foods/tempura	31.0	29.1	26.3	23.5	<0.001	27.6	23.5	25.0	20.6	0.002
Fried vegetable	48.1	46.5	45.8	40.1	0.001	49.3	42.3	43.0	43.2	0.04
Fresh fish	61.4	59.0	62.5	60.4	0.99	59.0	61.5	57.3	60.4	0.90
Kamaboko (fish paste)	15.9	14.9	12.9	12.9	0.05	17.1	16.5	17.6	14.3	0.15
Dried fish or salted fish	33.8	34.0	35.2	30.1	0.12	28.6	32.0	30.7	28.4	0.61
5/w and more, %										
Spinach/garland chrysanthemum										
	35.6	38.1	36.0	34.1	0.36	39.7	37.4	37.4	36.8	0.25
Carrot/pumpkin	15.8	16.0	16.2	17.4	0.33	27.1	25.0	25.5	26.9	0.88
Tomatoes	16.8	18.9	17.3	16.0	0.49	24.9	22.6	22.3	22.4	0.24
Cabbage/head lettuce	20.9	21.5	24.5	22.3	0.209	33.0	31.3	29.8	31.9	0.62
Chinese cabbage	16.2	19.1	17.6	18.1	0.42	17.7	17.0	18.7	19.4	0.23
Edible wild plants	3.9	4.2	3.3	1.7	0.01	4.5	3.4	3.5	3.0	0.11
Fungi (enokidake/shiitake)	6.1	7.8	7.2	8.2	0.10	9.0	9.2	9.5	9.3	0.84
Potatoes	15.2	15.4	14.3	19.9	0.01	23.8	19.1	19.8	23.5	0.64
Algae (seaweeds)	29.6	27.2	29.2	30.1	0.63	39.1	37.7	37.4	41.4	0.22
Pickles	64.7	61.5	61.9	59.5	0.01	68.7	65.9	63.3	62.1	0.001
Preserved foods/soy sauce	6.9	7.1	5.5	6.2	0.31	8.3	7.0	8.6	6.4	0.21
Boiled beans	5.5	5.0	4.9	6.2	0.53	5.6	7.2	6.9	8.5	0.03
Tofu (soybean curd)	37.6	32.8	35.9	31.3	0.01	44.8	38.5	34.9	36.8	<0.001
Citrus fruits	30.2	27.8	25.8	30.9	0.96	39.4	43.0	44.3	48.1	<0.001
Fresh fruits juice (summer)	12.5	16.0	12.8	14.7	0.45	14.0	13.3	15.1	18.8	0.002
Fruits (excluding citrus)	22.1	23.2	25.2	31.2	<0.001	37.5	38.0	40.8	48.1	<0.001
Sweets	22.3	19.6	16.1	12.4	<0.001	27.7	27.3	25.6	17.9	<0.001
Coffee	19.2	18.0	18.9	21.9	0.20	19.1	22.6	22.3	26.5	<0.001
Tea	0.6	1.0	1.5	0.9	0.32	0.8	1.9	1.0	2.4	0.02
Green tea	67.9	68.5	69.1	68.4	0.79	65.1	68.6	66.5	67.5	0.56
Oolong tea	2.2	2.9	4.2	5.3	<0.001	5.7	6.1	8.4	10.0	<0.001
3/d and more, %										
Bowls of rice (at present)	84.8	82.9	81.0	76.4	<0.001	76.3	77.5	73.1	68.4	<0.001
Bowls of rice (at 30 years old)	93.0	92.7	92.6	91.8	0.30	88.7	89.3	88.3	86.8	0.11
Bowls of miso (at present)	39.5	39.2	38.6	34.5	0.031	23.1	24.1	21.2	22.9	0.674
Bowls of miso (at 30 years old)	56.2	58.3	54.9	57.0	0.96	45.2	43.7	41.1	43.6	0.42

3 levels had lower mean intakes of energy, protein, carbohydrate, sodium, zinc, copper, polyunsaturated fat and vegetable oil. Women with higher IGFBP-3 levels higher mean intake of calcium.

Frequency of food intakes according to quartiles of TGF- β 1 (Table 8)

Persons with higher TGF- β 1 levels had higher proportions of 5 or more serving/week of potatoes intake

Table 7. Sex-specific Age-adjusted Mean and Standard Error of Energy and Nutrient Intakes According to Quartiles of Serum IGFBP-3 Levels

	Men					Women				
	Q1 ≤2.43	Q2 2.43-2.92	Q3 2.92-3.46	Q4 >3.46	p for trend	Q1 ≤2.43	Q2 2.43-2.92	Q3 2.92-3.46	Q4 >3.46	p for trend
Energy, kcal	1,816 (17.3)	1,849 (16.9)	1,804 (18.1)	1,749 (18.9)	0.003	1,491 (15.1)	1,488 (13.8)	1,438 (12.2)	1,434 (11.6)	<0.001
Protein, g	60.1 (0.6)	60.2 (0.6)	59.1 (0.6)	58.0 (0.6)	0.01	56.7 (0.6)	56.4 (0.6)	54.2 (0.5)	55.1 (0.5)	0.02
Fat, g	33.5 (0.4)	33.2 (0.4)	32.8 (0.4)	32.4 (0.4)	0.06	33.1 (0.4)	32.5 (0.4)	31.4 (0.4)	32.4 (0.3)	0.21
Carbohydrate, g	272 (3.1)	277 (3.1)	269 (3.3)	254 (3.4)	0.001	235 (2.7)	235 (2.5)	228 (2.2)	224 (2.1)	<0.001
Metals, mg										
Sodium	2,443 (33.0)	2,396 (32.3)	2,301 (34.6)	2,253 (36.1)	0.001	2,214 (35.3)	2,167 (32.2)	2,025 (28.5)	2,062 (27.2)	0.001
Potassium	2,389 (25.4)	2,405 (24.8)	2,385 (26.6)	2,388 (27.7)	0.88	2,389 (28.6)	2,392 (26.1)	2,352 (23.1)	2,442 (22.0)	0.14
Calcium	512 (6.2)	516 (6.0)	517 (6.5)	522 (6.7)	0.28	505 (7.0)	509 (6.4)	502 (5.7)	533 (5.4)	0.001
Magnesium	243 (2.3)	243 (2.3)	23 (2.5)	235 (2.6)	0.01	232 (2.5)	231 (2.3)	223 (2.0)	229 (1.9)	0.32
Phosphate	945 (9.1)	950 (8.9)	936 (9.5)	924 (10.0)	0.09	898 (10.0)	896 (9.1)	869 (8.1)	894 (7.7)	0.54
Iron, g	8.2 (0.1)	8.3 (0.1)	8.1 (0.1)	7.9 (0.1)	0.02	7.7 (0.1)	7.8 (0.1)	7.5 (0.1)	7.6 (0.1)	0.11
Zinc	8.0 (0.1)	8.1 (0.1)	7.9 (0.1)	7.6 (0.1)	0.001	7.3 (0.1)	7.3 (0.1)	7.0 (0.1)	7.0 (0.1)	0.001
Copper	1.3 (0.0)	1.3 (0.0)	1.3 (0.0)	1.2 (0.0)	0.001	1.2 (0.0)	1.2 (0.0)	1.1 (0.0)	1.1 (0.0)	0.001
Manganese	5.8 (0.1)	6.1 (0.1)	6.1 (0.1)	5.9 (0.1)	0.42	5.1 (0.1)	5.5 (0.1)	5.4 (0.1)	5.5 (0.1)	0.07
Vitamins, mg										
Retinol*, µg	558 (28.9)	625 (28.3)	647 (30.3)	535 (31.6)	0.69	514 (33.9)	567 (31.0)	539 (27.4)	521 (26.1)	0.80
Carotene, µg	3,264 (47.9)	3,253 (46.9)	3,185 (50.2)	3,204 (52.4)	0.29	3,499 (55.1)	3,386 (50.3)	3,343 (44.5)	3,505 (42.3)	0.61
Vitamin A, IU	1,142 (31.1)	1,212 (30.4)	1,223 (32.6)	1,114 (34.0)	0.59	1,133 (36.6)	1,172 (33.4)	1,138 (29.5)	1,146 (28.1)	1.00
Vitamin D	8.2 (0.1)	8.3 (0.1)	8.1 (0.1)	8.3 (0.2)	0.96	8.1 (0.2)	8.2 (0.1)	7.9 (0.1)	8.0 (0.1)	0.35
Vitamin E	5.4 (0.1)	5.4 (0.1)	5.3 (0.1)	5.3 (0.1)	0.04	5.5 (0.1)	5.4 (0.1)	5.2 (0.1)	5.4 (0.1)	0.30
Vitamin K	201 (2.8)	202 (2.7)	197 (2.9)	193 (3.0)	0.02	203 (3.1)	198 (2.8)	193 (2.5)	199 (2.4)	0.38
Vitamin B1	0.78 (0.0)	0.78 (0.0)	0.77 (0.0)	0.76 (0.0)	0.07	0.78 (0.0)	0.76 (0.0)	0.74 (0.0)	0.76 (0.0)	0.10
Vitamin B2	1.25 (0.0)	1.30 (0.0)	1.31 (0.0)	1.29 (0.0)	0.18	1.23 (0.0)	1.27 (0.0)	1.25 (0.0)	1.30 (0.0)	0.01
Niacin	13.6 (0.2)	13.6 (0.2)	13.4 (0.2)	13.2 (0.2)	0.04	13.1 (0.2)	13.2 (0.2)	12.8 (0.1)	12.9 (0.1)	0.12
Vitamin B6	1.10 (0.0)	1.11 (0.0)	1.10 (0.0)	1.09 (0.0)	0.42	1.10 (0.0)	1.09 (0.0)	1.06 (0.0)	1.09 (0.0)	0.52
Vitamin B12	8.2 (0.1)	8.3 (0.1)	8.3 (0.2)	7.9 (0.2)	0.20	7.6 (0.2)	7.8 (0.1)	7.3 (0.1)	7.4 (0.1)	0.12
Folic acid	418 (6.2)	438 (6.0)	433 (6.4)	420 (6.7)	0.94	404 (7.0)	418 (6.4)	409 (5.7)	417 (5.4)	0.27
Pantothenic A	5.5 (0.1)	5.6 (0.1)	5.6 (0.1)	5.4 (0.1)	0.33	5.3 (0.1)	5.3 (0.1)	5.2 (0.1)	5.3 (0.0)	0.97
Vitamin C	122 (1.8)	125 (1.7)	125 (1.9)	127 (1.9)	0.09	129 (2.0)	129 (1.8)	129 (1.6)	136 (1.5)	0.001
Fat, g										
Saturated	9.7 (0.1)	9.7 (0.1)	9.7 (0.1)	9.8 (0.1)	0.91	9.8 (0.1)	9.7 (0.1)	9.5 (0.1)	10.0 (0.1)	0.23
Monounsaturated	10.5 (0.1)	10.4 (0.1)	10.3 (0.1)	10.1 (0.1)	0.04	10.6 (0.2)	10.3 (0.1)	9.9 (0.1)	10.2 (0.1)	0.06
Polyunsaturated	8.0 (0.1)	7.9 (0.1)	7.7 (0.1)	7.5 (0.1)	0.001	7.6 (0.1)	7.4 (0.1)	7.0 (0.1)	7.1 (0.1)	0.001
Cholesterol, mg	282 (3.9)	285 (3.9)	277 (4.1)	278 (4.3)	0.26	283 (4.6)	273 (4.2)	264 (3.7)	272 (3.6)	0.09
Dietary fiber, g										
Soluble	2.0 (0.0)	2.0 (0.0)	1.9 (0.0)	1.9 (0.0)	0.06	2.0 (0.0)	2.0 (0.0)	1.9 (0.0)	2.0 (0.0)	0.55
Insoluble	8.3 (0.1)	8.3 (0.1)	8.1 (0.1)	7.9 (0.1)	0.002	8.1 (0.1)	7.9 (0.1)	7.7 (0.1)	7.9 (0.1)	0.08
Total	11.3 (0.1)	11.3 (0.1)	11.0 (0.1)	10.8 (0.1)	0.01	11.2 (0.1)	11.0 (0.1)	10.6 (0.1)	10.9 (0.1)	0.12
Salt, g	6.1 (0.1)	6.0 (0.1)	5.8 (0.1)	5.6 (0.1)	0.001	5.5 (0.1)	5.4 (0.1)	5.1 (0.1)	5.2 (0.1)	0.001
Animal fat, g	15.2 (0.2)	15.2 (0.2)	15.2 (0.2)	15.3 (0.3)	0.72	15.7 (0.3)	15.4 (0.3)	15.1 (0.2)	15.9 (0.2)	0.45
Fish fat, g	4.6 (0.1)	4.5 (0.1)	4.5 (0.1)	4.6 (0.1)	0.76	4.4 (0.1)	4.5 (0.1)	4.3 (0.1)	4.4 (0.1)	0.40
Vegetable oil, g	13.7 (0.2)	13.5 (0.2)	13.1 (0.2)	12.5 (0.2)	0.001	13.0 (0.2)	12.6 (0.2)	12.0 (0.2)	12.1 (0.1)	0.001

*equivalents

and of 3 or more servings/day of miso soup intake (both at present and 30 years old), and lower proportions of 5 or more servings/week of coffee intake for both men and women.

Mean energy and nutrient intakes according to quartiles of TGF-β1 (Table 9)

Persons with higher TGF-β1 levels had higher mean

intake of sodium for both men and women.

Frequency of food intakes according to quartiles of total SOD activity (Table 10)

For both men and women, persons with higher total SOD activity levels had higher proportions of 5 or more servings/week of fungi, coffee and tea intakes, and lower proportions of 3 or more serving/week of pork, chicken

Table 8. Sex-specific Age-adjusted Proportions of Higher Frequency of Foods According to Quartiles of Serum TGF-β1 Levels

ng/ml	Men					Women				
	Q1 ≤30.6	Q2 30.6-35.9	Q3 35.9-41.6	Q4 >41.6	p for trend	Q1 ≤30.6	Q2 30.6-35.9	Q3 35.9-41.6	Q4 >41.6	p for trend
3-4/w and more, %										
Beef	12.6	11.1	9.8	10.4	0.11	14.5	11.0	12.3	13.5	0.50
Pork (excluding ham/sausage)	21.1	23.5	24.9	24.6	0.06	19.2	23.6	25.7	24.3	0.002
Ham/sausage	14.9	15.5	15.1	14.5	0.72	13.1	15.7	15.0	13.3	0.85
Chicken	23.5	20.2	21.1	22.5	0.92	22.3	26.9	27.1	27.0	0.01
Liver	5.0	4.6	6.1	3.7	0.33	4.8	3.8	5.7	3.8	0.70
Eggs	73.2	74.1	76.2	71.2	0.24	70.4	69.7	71.4	70.2	0.88
Milk	55.7	56.7	56.0	54.8	0.53	63.2	60.3	59.5	59.5	0.06
Yogurt	7.3	8.1	7.3	6.5	0.37	12.7	11.7	11.6	11.3	0.34
Cheese	8.2	8.0	6.3	8.2	0.91	7.2	6.4	6.4	6.6	0.61
Butter	8.3	8.1	9.5	7.4	0.59	9.3	10.5	9.0	9.2	0.80
Margarine	16.7	15.9	14.1	12.8	0.01	23.2	19.6	17.8	20.1	0.05
Deep- fried foods/tempura	23.9	30.0	27.8	28.2	0.20	22.8	24.1	22.8	26.0	0.19
Fried vegetables	44.8	49.1	43.2	44.8	0.38	41.2	43.3	44.6	49.2	0.001
Fresh fish	61.1	63.1	61.4	58.1	0.05	57.8	60.1	60.1	60.8	0.15
Kamaboko (fish paste)	16.0	13.7	13.9	14.2	0.45	16.9	14.9	17.3	15.8	0.82
Dried fish/salted fish	33.0	33.7	33.7	33.1	0.96	29.7	29.6	30.7	29.8	0.82
5/w and more, %										
Spinach/garland chrysanthemum										
	37.5	36.3	35.0	35.9	0.45	38.5	37.4	37.0	37.7	0.65
Carrot/pumpkin	15.1	17.8	15.9	16.4	0.79	24.8	25.7	25.5	29.4	0.03
Tomatoes	15.9	18.5	16.3	18.3	0.31	23.2	23.8	21.5	23.0	0.66
Cabbage/head lettuce	19.1	23.6	21.2	23.8	0.04	32.1	31.4	30.4	31.5	0.63
Chinese cabbage	16.3	18.4	16.8	18.9	0.25	15.2	19.2	20.1	20.0	0.01
Edible wild plants	3.4	4.4	2.8	3.0	0.29	2.4	3.9	3.9	4.3	0.03
Fungi (enokidake/shiitake)	6.8	9.4	5.8	7.1	0.50	9.3	8.8	9.7	9.2	0.93
Potatoes	15.3	14.5	13.9	19.5	<0.001	19.0	19.3	23.3	26.5	<0.001
Algae (seaweeds)	27.9	29.8	27.0	30.7	0.24	39.4	40.1	38.9	37.0	0.23
Pickles	59.5	64.1	61.5	62.9	0.26	61.5	64.3	65.7	68.6	<0.001
Preserved foods/soy sauce	5.7	6.6	6.8	6.5	0.50	7.4	7.3	6.5	9.2	0.25
Boiled beans	4.9	5.8	5.0	5.5	0.74	7.5	6.8	6.7	7.7	0.96
Tofu (soybean curd)	31.6	35.1	34.3	36.2	0.05	37.2	37.8	39.3	39.8	0.15
Citrus fruits	29.3	28.8	28.4	28.6	0.74	43.0	42.6	45.4	46.1	0.09
Fresh fruits juice (summer)	13.3	16.3	13.5	12.6	0.25	15.6	16.6	15.6	14.1	0.38
Fruits (excluding citrus)	26.2	25.2	22.3	26.3	0.99	42.0	40.8	41.6	41.8	1.00
Sweets	17.8	18.4	19.2	17.2	0.66	23.1	26.8	23.6	23.4	0.86
Coffee	23.4	20.5	17.0	17.0	<0.001	28.0	20.8	20.1	19.4	<0.001
Tea	1.4	1.1	0.8	0.9	0.24	2.1	1.7	0.8	1.6	0.20
Green tea	68.7	69.3	67.5	68.4	0.75	67.0	67.0	67.2	66.5	0.87
Oolong tea	4.9	3.3	3.3	3.0	0.08	9.5	7.9	7.5	5.6	0.003
3/d and more, %										
Bowls of rice (at present)	78.7	83.5	82.1	81.7	0.26	69.5	73.4	77.7	74.8	<0.001
Bowls of rice (at 30 years old)	91.5	93.6	92.5	92.4	0.77	86.5	89.2	88.1	89.7	0.04
Bowls of miso (at present)	31.1	38.5	42.1	39.3	0.001	17.8	23.3	26.3	24.7	<0.001
Bowls of miso (at 30 years old)	45.1	58.2	60.3	59.4	<0.001	34.7	43.6	48.9	48.3	<0.001

and eggs intakes, 5 or more serving/week of Chinese cabbage, pickles and sweets intakes and 3 or more servings/day of rice intake at present. Tomatoes and miso were only significant in females.

Mean energy and nutrient intakes according to quartiles of total SOD activity (Table 11)

For both men and women, persons with higher total SOD activity levels had lower mean intakes of most

Table 9. Sex-specific Age-adjusted Mean and Standard Error of Energy and Nutrient Intakes According to Quartiles of Serum TGF-β1 Levels

ng/ml	Men					Women				
	Q1 <30.6	Q2 30.6-35.9	Q3 35.9-41.6	Q4 >41.6	p for trend	Q1 <30.6	Q2 30.6-35.9	Q3 35.9-41.6	Q4 >41.6	p for trend
Energy, kcal	1,764 (20.7)	1,830 (17.8)	1,817 (17.1)	1,807 (16.3)	0.30	1,431 (11.9)	1,444 (12.5)	1,475 (13.3)	1,493 (14.1)	<0.001
Protein, g	58.3 (0.7)	60.6 (0.6)	59.7 (0.6)	59.1 (0.6)	0.91	54.2 (0.5)	55.2 (0.5)	56.4 (0.6)	56.6 (0.6)	<0.001
Fat, g	32.7 (0.5)	33.8 (0.4)	33.0 (0.4)	32.6 (0.4)	0.41	31.9 (0.4)	32.2 (0.4)	32.5 (0.4)	32.8 (0.4)	0.09
Carbohydrate, g	263 (3.8)	273 (3.2)	270 (3.1)	267 (3.0)	0.75	225 (2.1)	227 (2.3)	233 (2.4)	236 (2.6)	<0.001
Metals, mg										
Sodium	2,236 (39.5)	2,413 (34.0)	2,369 (32.7)	2,378 (31.2)	0.04	1,954 (27.7)	2,102 (29.1)	2,189 (31.1)	2,221 (33.0)	<0.001
Potassium	2,375 (30.3)	2,448 (26.1)	2,370 (25.1)	2,383 (23.9)	0.59	2,351 (22.5)	2,395 (23.6)	2,417 (25.3)	2,438 (26.8)	0.01
Calcium	512 (7.4)	527 (6.3)	514 (6.1)	515 (5.8)	0.81	508 (5.5)	513 (5.8)	516 (6.2)	521 (6.6)	0.12
Magnesium	235 (2.8)	245 (2.4)	240 (2.3)	240 (2.2)	0.70	222 (2.0)	228 (2.1)	232 (2.2)	234 (2.4)	<0.001
Phosphate	925 (10.9)	958 (9.4)	942 (9.0)	933 (8.6)	0.89	872 (7.9)	884 (8.3)	900 (8.9)	904 (9.4)	0.004
Iron, g	7.9 (0.1)	8.3 (0.1)	8.2 (0.1)	8.1 (0.1)	0.57	7.4 (0.1)	7.6 (0.1)	7.8 (0.1)	7.8 (0.1)	<0.001
Zinc	7.7 (0.1)	8.0 (0.1)	8.0 (0.1)	7.9 (0.1)	0.66	7.0 (0.1)	7.0 (0.1)	7.2 (0.1)	7.3 (0.1)	0.001
Copper	1.3 (0.0)	1.3 (0.0)	1.3 (0.0)	1.3 (0.0)	0.32	1.1 (0.0)	1.1 (0.0)	1.2 (0.0)	1.2 (0.0)	<0.001
Manganese	6.0 (0.1)	6.1 (0.1)	6.0 (0.1)	5.9 (0.1)	0.32	5.3 (0.1)	5.5 (0.1)	5.5 (0.1)	5.4 (0.1)	0.75
Vitamins										
Retinol*, µg	587 (34.7)	585 (29.9)	651 (28.8)	559 (27.4)	0.63	564 (26.7)	550 (28.0)	522 (30.0)	490 (31.8)	0.06
Carotene, µg	3,201 (57.4)	3,303 (49.4)	3,169 (47.6)	3,253 (45.3)	0.88	3,355 (43.3)	3,422 (45.5)	3,441 (48.8)	3,551 (51.7)	<0.001
Vitamin A, IU	1,164 (37.3)	1,181 (32.1)	1,222 (30.9)	1,144 (29.5)	0.65	1,163 (28.8)	1,161 (30.2)	1,136 (32.4)	1,121 (34.3)	0.29
Vitamin D	8.2 (0.2)	8.4 (0.1)	8.2 (0.1)	8.1 (0.1)	0.46	7.8 (0.1)	8.0 (0.1)	8.3 (0.1)	8.2 (0.1)	0.03
Vitamin E	5.3 (0.1)	5.5 (0.1)	5.3 (0.1)	5.4 (0.1)	0.98	5.2 (0.1)	5.3 (0.1)	5.4 (0.1)	5.5 (0.1)	0.001
Vitamin K	197 (3.3)	202 (2.8)	196 (2.7)	200 (2.6)	0.74	193 (2.5)	197 (2.6)	200 (2.8)	204 (2.9)	0.002
Vitamin B1	0.76 (0.0)	0.79 (0.0)	0.78 (0.0)	0.77 (0.0)	0.72	0.74 (0.0)	0.76 (0.0)	0.76 (0.0)	0.78 (0.0)	<0.001
Vitamin B2	1.29 (0.0)	1.31 (0.0)	1.29 (0.0)	1.26 (0.0)	0.11	1.26 (0.0)	1.27 (0.0)	1.27 (0.0)	1.25 (0.0)	0.67
Niacin	13.4 (0.2)	13.8 (0.2)	13.5 (0.2)	13.3 (0.1)	0.23	12.7 (0.1)	13.0 (0.1)	13.2 (0.2)	13.1 (0.2)	0.07
Vitamin B6	1.09 (0.0)	1.12 (0.0)	1.10 (0.0)	1.10 (0.0)	0.95	1.06 (0.0)	1.08 (0.0)	1.10 (0.0)	1.11 (0.0)	0.001
Vitamin B12	8.0 (0.2)	8.3 (0.1)	8.4 (0.1)	8.1 (0.1)	0.92	7.3 (0.1)	7.6 (0.1)	7.7 (0.1)	7.5 (0.2)	0.22
Folic acid	424 (7.4)	436 (6.3)	429 (6.1)	423 (5.8)	0.59	406 (5.5)	417 (5.8)	415 (6.2)	414 (6.6)	0.36
Pantothenic A	5.5 (0.1)	5.6 (0.1)	5.6 (0.1)	5.5 (0.1)	0.61	5.3 (0.0)	5.3 (0.1)	5.4 (0.1)	5.4 (0.1)	0.10
Vitamin C	125 (2.1)	128 (1.8)	122 (1.8)	125 (1.7)	0.51	129 (1.6)	132 (1.7)	131 (1.8)	134 (1.9)	0.07
Fat, g										
Saturated	9.8 (0.2)	9.9 (0.1)	9.7 (0.1)	9.5 (0.1)	0.08	9.8 (0.1)	9.7 (0.1)	9.7 (0.1)	9.8 (0.1)	0.76
Monounsaturated	10.3 (0.2)	10.6 (0.1)	10.3 (0.1)	10.2 (0.1)	0.28	10.1 (0.1)	10.2 (0.1)	10.2 (0.1)	10.3 (0.1)	0.20
Polyunsaturated	7.5 (0.1)	8.0 (0.1)	7.8 (0.1)	7.8 (0.1)	0.29	6.9 (0.1)	7.2 (0.1)	7.4 (0.1)	7.5 (0.1)	<0.001
Cholesterol, mg	278 (4.7)	285 (4.1)	285 (3.9)	276 (3.7)	0.49	270 (3.7)	268(3.8)	277 (4.1)	275 (4.4)	0.21
Dietary Fiber, g										
Soluble	1.9 (0.0)	2.0 (0.0)	1.9 (0.0)	2.0 (0.0)	0.21	1.9 (0.0)	2.0(0.0)	2.0 (0.0)	2.1 (0.0)	<0.001
Unsoluble	7.9 (0.1)	8.4 (0.1)	8.1 (0.1)	8.2 (0.1)	0.21	7.5 (0.1)	7.8 (0.1)	8.0 (0.1)	8.2 (0.1)	<0.001
Total	10.8 (0.2)	11.3 (0.1)	11.0 (0.1)	11.2 (0.1)	0.15	10.5 (0.1)	10.8 (0.1)	11.1 (0.1)	11.4 (0.1)	<0.001
Salt, g	5.6 (0.1)	6.0 (0.1)	5.9 (0.1)	5.9 (0.1)	0.04	4.9 (0.1)	5.3 (0.1)	5.5 (0.1)	5.6 (0.1)	<0.001
Animal fat, g	15.3 (0.3)	15.6 (0.2)	15.3 (0.2)	14.9 (0.2)	0.13	15.8 (0.2)	15.4 (0.2)	15.5 (0.3)	15.4 (0.3)	0.29
Fish fat, g	4.6 (0.1)	4.6 (0.1)	4.5 (0.1)	4.5 (0.1)	0.36	4.3 (0.1)	4.4 (0.1)	4.5 (0.1)	4.4 (0.1)	0.07
Vegetable oil, g	12.8 (0.2)	13.6 (0.2)	13.2 (0.2)	13.2 (0.2)	0.48	11.8 (0.1)	12.4 (0.2)	12.5 (0.2)	12.9 (0.2)	<0.001

* equivalents

nutrients other than energy, carbohydrate, potassium, iron, copper, manganese, retinol equivalents, vitamin A, B2, B12, niacin, folic acid, vitamin C and fish fat.

Frequency of food intakes according to quartiles of sFas (Table 12)

For both men and women, persons with higher sFas levels had higher proportions of 5 or more serving/week

of pickles and sweets intakes, and lower proportions of 5 or more serving/week of potatoes intake.

Mean energy and nutrient intakes according to quartiles of sFas (Table 13)

Persons with higher sFas levels had higher mean intakes of manganese and folic acids for both men and women.

Table 10. Sex-specific Age-adjusted Proportions of Higher Frequency of Foods According to Quartiles of Serum Total SOD Activity

U/ml	Men					Women				
	Q1 ≤ 2.3	Q2 2.3-2.6	Q3 2.6-3.1	Q4 >3.1	p for trend	Q1 ≤ 2.3	Q2 2.3-2.6	Q3 2.6-3.1	Q4 >3.1	p for trend
3-4/w and more, %										
Beef	12.0	11.3	9.2	10.0	0.08	12.7	12.9	12.1	13.7	0.47
Pork (excluding ham/sausage)	26.0	23.8	20.9	21.4	0.003	27.0	24.9	21.3	19.7	<0.001
Ham/sausage	15.9	14.0	14.2	14.5	0.34	16.3	15.5	12.9	12.9	0.02
Chicken	23.5	22.4	19.6	19.8	0.01	28.0	28.2	24.5	22.7	0.001
Liver	4.9	4.7	4.2	5.5	0.55	5.0	3.7	5.2	4.3	0.69
Eggs	76.7	74.0	72.1	67.9	<0.001	73.7	73.1	69.9	66.2	<0.001
Milk	55.7	56.7	59.0	51.0	0.034	60.6	59.9	61.5	61.1	0.66
Yogurt	5.7	8.5	8.5	7.6	0.11	12.2	11.3	12.2	11.9	0.95
Cheese	7.0	8.4	9.6	5.9	0.47	9.1	5.6	6.6	5.8	0.04
Butter	8.3	7.4	8.0	9.3	0.38	10.7	8.4	8.4	10.5	0.59
Margarine	13.9	15.6	15.9	13.8	0.92	19.1	19.7	19.5	22.6	0.05
Deep- fried foods/tempura	28.7	28.5	27.0	26.0	0.14	24.7	25.4	23.6	22.4	0.14
Fried vegetables	47.1	45.0	44.8	43.4	0.10	48.7	47.0	39.6	43.5	0.03
Fresh fish	62.0	61.3	58.8	59.8	0.18	61.5	57.9	59.7	59.0	0.42
Kamaboko (fish paste)	14.3	14.0	15.3	13.5	0.69	17.2	14.5	15.7	17.4	0.46
Dried fish/salted fish	34.8	33.6	31.9	32.2	0.14	33.0	32.2	28.0	27.5	0.002
5/w and more, %										
Spinach/garland chrysanthemum										
	37.4	35.6	33.7	36.3	0.50	39.7	35.9	35.5	39.5	0.55
Carrot/pumpkin	15.5	17.6	16.3	16.3	0.73	27.2	28.6	25.6	24.0	0.03
Tomatoes	16.8	17.1	17.7	18.3	0.28	22.1	19.4	22.9	26.2	0.002
Cabbage/head lettuce	22.6	22.8	21.2	21.4	0.393	31.0	31.2	30.9	32.4	0.42
Chinese cabbage	19.0	17.9	17.4	15.7	0.05	21.0	19.9	17.6	16.3	0.01
Edible wild plants	2.4	3.9	4.1	3.9	0.05	3.9	2.9	3.1	4.1	0.51
Fungi (enokidake/hiitake)	6.6	7.2	6.8	9.0	0.04	8.0	8.8	8.6	10.9	0.02
Potatoes	15.6	18.2	15.7	14.6	0.36	25.2	23.6	21.1	17.5	<0.001
Algae (seaweeds)	28.9	29.1	30.8	27.0	0.39	39.7	37.6	39.4	39.0	0.99
Pickles	64.0	65.3	58.5	58.1	<0.001	68.3	69.0	61.6	61.3	<0.001
Preserved foods/soy sauce	6.9	6.3	6.2	6.0	0.37	8.0	7.0	7.4	7.6	0.94
Boiled beans	5.4	5.1	5.4	5.7	0.74	8.1	7.7	6.6	6.7	0.24
Tofu (soybean curd)	36.6	34.2	34.4	31.2	0.01	39.4	38.9	38.3	37.0	0.21
Citrus fruits	29.3	28.3	28.1	28.1	0.50	48.8	47.4	40.1	41.7	<0.001
Fresh fruit juice (summer)	12.7	14.4	13.8	15.8	0.06	18.0	13.6	14.2	16.5	0.99
Fruits (excluding citrus)	24.0	26.1	26.1	24.5	0.80	42.2	41.6	42.3	40.3	0.36
Sweets	19.0	19.9	15.9	16.4	0.03	27.2	27.8	23.6	20.0	<0.001
Coffee	15.9	19.6	23.5	21.3	<0.001	18.4	20.1	22.9	27.4	<0.001
Tea	0.7	0.8	1.0	1.9	0.01	1.4	1.2	1.1	2.5	0.02
Green tea	65.6	70.3	72.3	67.4	0.44	65.0	65.0	69.7	67.1	0.35
Oolong tea	2.9	2.8	5.1	3.8	0.132	5.2	5.9	9.3	9.6	<0.001
3/d and more, %										
Bowls of rice (at present)	83.1	82.9	78.8	80.2	0.01	76.4	76.8	71.4	70.5	<0.001
Bowls of rice (at 30 years old)	92.8	92.2	92.2	93.1	0.79	89.9	88.9	88.2	86.4	0.01
Bowls of miso (at present)	37.8	37.0	38.8	40.1	0.24	24.1	22.4	22.7	21.8	0.31
Bowls of miso (at 30 years old)	57.9	56.8	53.7	56.7	0.40	46.7	44.6	43.9	38.4	<0.001

Discussion

In the present study, we examined the associations between food and nutrient intakes and IGF-I, IGF-II, IGFBP-3, TGF- β 1, total SOD activity and sFas levels

among middle-aged Japanese men and women.

Previous observational studies (Devine et al. 1998; Holmes et al. 2002; Giovannucci et al. 2003; Gunnell et al. 2003; DeLellis et al., 2004; Larsson et al., 2005; McGreevy et al., 2007; Norat et al., 2007; Crowe et al.

Table 11. Sex-specific Age-adjusted Mean and Standard Error of Energy and Nutrient Intakes According to Quartiles of Serum Total SOD Activity

U/ml	Men					Women				
	Q1 ≤2.3	Q2 2.3-2.6	Q3 2.6-3.1	Q4 >3.1	p for trend	Q1 ≤2.3	Q2 2.3-2.6	Q3 2.6-3.1	Q4 >3.1	p for trend
Energy, kcal	1,812 (14.8)	1,843 (18.7)	1,781 (19.4)	1,789 (18.9)	0.15	1,507 (14.0)	1,470 (14.5)	1,432 (12.2)	1,441 (11.4)	<0.001
Protein, g	60.2 (0.5)	60.7 (0.6)	58.4 (0.7)	57.9 (0.6)	0.001	58.0 (0.6)	55.7 (0.6)	54.7 (0.5)	54.3 (0.5)	<0.001
Fat, g	33.6 (0.3)	33.8 (0.4)	32.6 (0.4)	31.6 (0.4)	<0.001	33.7 (0.4)	32.5 (0.4)	31.8 (0.4)	31.6 (0.3)	<0.001
Carbohydrate	268 (2.7)	273 (3.4)	263 (3.5)	271 (3.4)	0.87	237 (2.5)	232 (2.6)	225 (2.2)	228 (2.1)	0.02
Metals, mg										
Sodium	2,416 (28.3)	2,409 (35.8)	2,275 (37.0)	2,272 (36.1)	<0.001	2,294 (32.7)	2,162 (33.9)	2,043 (28.4)	1,992 (26.6)	<0.001
Potassium	2,395 (21.7)	2,444 (27.5)	2,379 (28.4)	2,344 (27.7)	0.07	2,488 (26.6)	2,388 (27.5)	2,369 (23.1)	2,364 (21.6)	0.002
Calcium	524 (5.3)	524 (6.7)	519 (6.9)	495 (6.7)	<0.001	532 (6.5)	517 (6.8)	510 (5.7)	503 (5.3)	<0.001
Magnesium	242 (2.0)	245 (2.5)	237 (2.6)	236 (2.6)	0.01	239 (2.3)	229 (2.4)	224 (2.0)	224 (1.9)	<0.001
Phosphate	951 (7.8)	957 (9.9)	928 (10.2)	913 (9.9)	0.001	925 (9.3)	892 (9.6)	877 (8.1)	871 (7.6)	<0.001
Iron, g	8.2 (0.1)	8.3 (0.1)	8.0 (0.1)	8.0 (0.1)	0.08	8.0 (0.1)	7.6 (0.1)	7.5 (0.1)	7.5 (0.1)	<0.001
Zinc	8.0 (0.1)	8.1 (0.1)	7.8 (0.1)	7.8 (0.1)	0.03	7.4 (0.1)	7.1 (0.1)	7.0 (0.1)	7.0 (0.1)	<0.001
Copper	1.3 (0.0)	1.3 (0.0)	1.3 (0.0)	1.3 (0.0)	0.27	1.2 (0.0)	1.1 (0.0)	1.1 (0.0)	1.1 (0.0)	<0.001
Manganese	5.6 (0.1)	6.2 (0.1)	6.3 (0.1)	6.1 (0.1)	0.001	5.4 (0.1)	5.2 (0.1)	5.5 (0.1)	5.5 (0.1)	0.21
Vitamins, mg										
Retinol*, µg	596 (24.8)	608 (31.4)	565 (32.5)	594 (31.6)	0.81	527 (31.6)	455 (32.7)	562 (27.4)	565 (25.7)	0.08
Carotene, µg	3,299 (41.0)	3,272 (51.9)	3,123 (53.7)	3,168 (52.3)	0.02	3,612 (51.2)	3,432 (53.0)	3,318 (44.5)	3,415 (41.7)	0.02
Vitamin A, IU	1,184 (26.7)	1,199 (33.7)	1,134 (34.9)	1,167 (34.0)	0.51	1,167 (34.0)	1,064 (35.2)	1,157 (29.6)	1,175 (27.7)	0.27
Vitamin D	8.3 (0.1)	8.4 (0.2)	8.0 (0.2)	8.0 (0.2)	0.04	8.5 (0.1)	8.1 (0.2)	7.9 (0.1)	7.9 (0.1)	0.01
Vitamin E	5.5 (0.1)	5.5 (0.1)	5.2 (0.1)	5.2 (0.1)	<0.001	5.6 (0.1)	5.4 (0.1)	5.2 (0.1)	5.3 (0.1)	<0.001
Vitamin K	204 (2.4)	201 (3.0)	192 (3.1)	194 (3.0)	0.002	209 (2.9)	198 (3.0)	192 (2.5)	195 (2.4)	0.004
Vitamin B1	0.79 (0.0)	0.79 (0.0)	0.76 (0.0)	0.75 (0.0)	<0.001	0.80 (0.0)	0.76 (0.0)	0.74 (0.0)	0.74 (0.0)	<0.001
Vitamin B2	1.27 (0.0)	1.32 (0.0)	1.31 (0.0)	1.26 (0.0)	0.55	1.28 (0.0)	1.23 (0.0)	1.28 (0.0)	1.26 (0.0)	0.80
Niacin	13.5 (0.1)	13.8 (0.2)	13.3 (0.2)	13.4 (0.2)	0.32	13.5 (0.2)	12.8 (0.2)	12.8 (0.1)	12.9 (0.1)	0.03
Vitamin B6	1.11 (0.0)	1.13 (0.0)	1.08 (0.0)	1.08 (0.0)	0.02	1.13 (0.0)	1.08 (0.0)	1.07 (0.0)	1.07 (0.0)	<0.001
Vitamin B12	8.3 (0.1)	8.4 (0.2)	7.9 (0.2)	8.0 (0.2)	0.06	7.9 (0.2)	7.3 (0.2)	7.5 (0.1)	7.4 (0.1)	0.09
Folic acid	419 (5.3)	438 (6.7)	430 (6.9)	426 (6.7)	0.62	422 (6.5)	398 (6.7)	414 (5.7)	414 (5.3)	0.99
Pantothenic acid	5.6 (0.0)	5.7 (0.1)	5.5 (0.1)	5.4 (0.1)	0.01	5.5 (0.1)	5.3 (0.1)	5.3 (0.1)	5.2 (0.0)	0.01
Vitamin C	123 (1.5)	127 (1.9)	126 (2.0)	124 (1.9)	0.91	136 (1.9)	129 (1.9)	130 (1.6)	131 (1.5)	0.11
Fat, g										
Saturated	9.9 (0.1)	9.9 (0.1)	9.7 (0.1)	9.2 (0.1)	<0.001	10.1 (0.1)	9.8 (0.1)	9.7 (0.1)	9.6 (0.1)	0.02
Monounsaturated	10.5 (0.1)	10.6 (0.1)	10.2 (0.1)	9.9 (0.1)	<0.001	10.7 (0.1)	10.2 (0.1)	10.1 (0.1)	10.0 (0.1)	0.002
Polyunsaturated	8.0 (0.1)	8.0 (0.1)	7.6 (0.1)	7.5 (0.1)	<0.001	7.7 (0.1)	7.3 (0.1)	7.1 (0.1)	7.0 (0.1)	<0.001
Cholesterol	289 (3.4)	288 (4.3)	275 (4.4)	264 (4.3)	<0.001	286 (4.3)	276 (4.5)	271 (3.7)	262 (3.5)	<0.001
Dietary Fiber, g										
Soluble	2.0 (0.0)	2.0 (0.0)	1.9 (0.0)	1.9 (0.0)	<0.001	2.1 (0.0)	2.0 (0.0)	1.9 (0.0)	1.9 (0.0)	<0.001
Unsoluble	8.3 (0.1)	8.3 (0.1)	7.9 (0.1)	8.0 (0.1)	0.01	8.3 (0.1)	8.0 (0.1)	7.6 (0.1)	7.7 (0.1)	<0.001
Total	11.3 (0.1)	11.3 (0.1)	10.8 (0.1)	10.9 (0.1)	0.003	11.5 (0.1)	11.1 (0.1)	10.6 (0.1)	10.6 (0.1)	<0.001
Salt, g	6.0 (0.1)	6.0 (0.1)	5.7 (0.1)	5.7 (0.1)	<0.001	5.7 (0.1)	5.4 (0.1)	5.1 (0.1)	5.0 (0.1)	<0.001
Animal fat, g	15.5 (0.2)	15.5 (0.3)	15.3 (0.3)	14.3 (0.3)	<0.001	16.0 (0.3)	15.6 (0.3)	15.5 (0.2)	15.3 (0.2)	0.04
Fish fat, g	4.6 (0.1)	4.7 (0.1)	4.4 (0.1)	4.5 (0.1)	0.14	4.6 (0.1)	4.4 (0.1)	4.3 (0.1)	4.3 (0.1)	0.03
Vegetable oil, g	13.5 (0.1)	13.5 (0.2)	12.9 (0.2)	12.8 (0.2)	0.001	13.1 (0.2)	12.5 (0.2)	12.0 (0.2)	12.1 (0.1)	<0.001

* equivalents

2009) indicated the positive associations of IGF-1 with milk and dairy products, vegetables, animal and dairy protein, calcium, potassium, zinc and fiber. Also, intervention surveys indicated increment of serum IGF-1 levels by intervention of milk (Cadogan et al., 1997; Heaney et al., 1999) and calcium fortified dairy product, but no association between IGF-1 and calcium supplement (Manios et al. 2007).

In the present study, we found that IGF-I levels were associated with higher intakes of milk, yogurt, calcium and saturated fat for both men and women, and were not associated with total protein and zinc intake. The majority of the findings from observational and intervention studies indicated that IGF-1 levels were not associated with saturated fat intake (Devine et al., 1998; Holmes et al. 2002; Giovannucci et al. 2003; Gunnell et al. 2003;

Table 12. Sex-specific Age-adjusted Proportions of Higher Frequency of Foods According to Quartiles of Serum sFas Levels

ng/ml	Men					Women				
	Q1 ≤1.8	Q2 1.8-2.2	Q3 2.2-2.6	Q4 >2.6	p for trend	Q1 ≤1.8	Q2 1.8-2.2	Q3 2.2-2.6	Q4 >2.6	p for trend
3-4/w and more, %										
Beef	9.7	10.3	10.4	13.1	0.01	13.4	13.4	12.7	11.7	0.27
Pork (excluding ham/sausage)	21.6	23.9	23.7	22.3	0.84	20.3	25.4	21.6	21.0	0.99
Ham/sausage	15.9	14.7	12.9	13.5	0.09	13.8	13.4	12.8	14.7	0.65
Chicken	19.9	22.3	19.6	21.0	0.79	24.4	25.9	23.1	23.3	0.40
Liver	5.0	4.4	3.6	6.2	0.31	3.3	5.1	4.7	5.5	0.06
Eggs	70.4	73.9	74.9	72.6	0.30	71.0	71.3	71.0	67.8	0.12
Milk	59.1	58.4	56.9	57.0	0.28	64.5	62.4	64.8	59.6	0.05
Yogurt	8.2	7.4	6.0	7.4	0.46	11.8	12.1	10.8	13.1	0.51
Cheese	8.1	7.6	6.3	7.1	0.35	6.3	7.1	4.6	6.4	0.71
Butter	7.5	7.7	7.6	9.3	0.21	9.3	9.7	8.4	9.6	0.98
Margarine	16.3	14.7	14.3	14.7	0.37	24.1	21.0	19.9	18.6	0.01
Deep- fried foods/tempura	29.8	28.0	24.9	25.9	0.05	22.2	24.6	22.6	23.3	0.75
Fried vegetables	45.2	46.5	40.6	45.3	0.67	41.6	43.5	43.7	40.3	0.71
Fresh fish	57.8	60.4	59.6	59.2	0.62	59.1	59.1	58.7	55.1	0.07
Kamaboko (fish paste)	16.0	13.4	13.0	14.6	0.47	12.7	17.4	17.5	17.6	0.01
Dried fish/salted fish	33.9	33.9	33.5	33.4	0.75	28.2	30.1	31.5	29.9	0.38
5/w and more, %										
Spinach/garland chrysanthemum	35.0	34.0	37.2	36.6	0.33	36.0	37.2	38.6	37.6	0.43
Carrot/pumpkin	15.8	15.6	15.7	14.4	0.38	26.0	24.9	26.8	23.6	0.33
Tomatoes	18.6	18.2	15.0	15.8	0.04	21.9	23.4	23.1	21.9	1.00
Cabbage/head lettuce	20.9	21.8	22.2	21.2	0.90	28.9	31.6	31.5	31.3	0.29
Chinese cabbage	17.8	18.1	20.3	17.4	0.98	17.9	19.5	19.4	18.0	0.91
Edible wild plants	2.6	3.8	3.6	3.6	0.30	3.9	3.5	2.9	3.0	0.31
Fungi (enokidake/shiitake)	6.8	7.7	6.8	7.6	0.61	8.1	10.1	10.0	8.1	0.91
Potatoes	15.7	14.6	15.1	12.3	0.03	22.6	19.9	19.0	15.4	<0.001
Algae (seaweeds)	27.3	27.8	29.0	27.4	0.91	37.2	40.8	39.6	35.7	0.41
Pickles	60.0	61.0	62.5	65.0	0.01	60.7	62.8	66.3	67.1	0.001
Preserved foods/soy sauce	7.3	7.6	4.2	7.2	0.55	8.0	7.7	7.7	7.5	0.68
Boiled beans	5.6	6.1	3.9	6.0	0.97	7.7	7.7	7.7	6.4	0.37
Tofu (soybean curd)	29.7	31.1	34.0	32.2	0.16	34.3	35.1	36.2	35.9	0.41
Citrus fruits	26.7	27.7	31.5	33.9	<0.001	45.4	47.2	45.5	47.2	0.55
Fresh fruits juice (summer)	14.8	14.2	16.0	16.5	0.27	16.2	17.7	17.0	16.2	0.98
Fruits (excluding citrus)	23.2	26.6	24.7	26.1	0.23	45.6	41.6	41.1	40.1	0.02
Sweets	12.5	18.0	19.5	23.1	<0.001	19.3	23.2	25.7	28.6	<0.001
Coffee	22.0	21.5	21.0	20.1	0.31	30.1	25.9	23.2	20.1	<0.001
Tea	0.6	1.3	1.1	1.6	0.07	2.2	1.8	1.0	1.9	0.44
Green tea	68.2	71.5	71.5	72.5	0.07	66.1	69.5	71.3	68.6	0.21
Oolong tea	3.2	4.4	3.1	5.2	0.09	8.1	9.9	10.1	6.5	0.40
3/d and more, %										
Bowls of rice (at present)	78.8	82.8	81.9	81.2	0.27	69.1	73.7	75.6	74.9	0.003
Bowls of rice (at 30 years old)	92.1	93.0	91.7	92.0	0.78	85.9	88.2	88.8	87.8	0.22
Bowls of miso (at present)	40.3	38.9	32.1	33.7	0.001	20.5	21.9	22.1	22.1	0.49
Bowls of miso (at 30 years old)	61.0	56.3	48.8	50.0	<0.001	39.1	40.5	39.9	39.2	0.99

DeLellis et al., 2004; Larsson et al., 2005; McGreevy et al., 2007; Norat et al., 2007; Crowe et al. 2009). Thus, the positive association between saturated fat intake and IGF-1 levels in the present study might be due to chance, but remained to be examined further.

IGFBP-3 levels have been associated with higher intakes of processed meat, calcium and phosphorus (Norat et al., 2007; Crowe et al., 2009). In the present study, we found that positive associations of IGFBP-3 levels with intakes of milk and yogurt for both men and women and

Table 13. Sex-specific Age-adjusted Mean and Standard Error of Energy and Nutrient Intakes According to Quartiles of Serum sFas Levels

ng/ml	Men					Women				
	Q1 ≤1.8	Q2 1.8-2.2	Q3 2.2-2.6	Q4 >2.6	p for trend	Q1 ≤1.8	Q2 1.8-2.2	Q3 2.2-2.6	Q4 >2.6	p for trend
Energy, kcal	1,813 (18.1)	1,803 (17.6)	1,828 (20.1)	1,772 (19.5)	0.19	1,439 (12.7)	1,463 (12.4)	1,481 (15.0)	1,453 (15.8)	0.34
Protein, g	59.5 (0.6)	59.1 (0.6)	59.5 (0.7)	58.9 (0.7)	0.61	54.4 (0.5)	55.7 (0.5)	56.3 (0.6)	54.6 (0.7)	0.57
Fat, g	33.4 (0.4)	32.9 (0.4)	32.9 (0.5)	32.6 (0.4)	0.22	32.0 (0.4)	32.6 (0.4)	32.6 (0.4)	31.3 (0.5)	0.35
Carbohydrate, g	261 (3.3)	264 (3.2)	277 (3.7)	272 (3.5)	0.01	226 (2.3)	230 (2.3)	234 (2.7)	232 (2.9)	0.10
Metals, mg										
Sodium	2,415 (34.8)	2,348 (33.8)	2,258 (38.7)	2,216 (37.4)	<0.001	1,992 (29.3)	2,097 (28.8)	2,101 (34.8)	2,040 (36.7)	0.23
Potassium	2,409 (26.9)	2,405 (26.1)	2,439 (29.9)	2,413 (28.9)	0.80	2,380 (23.9)	2,436 (23.5)	2,451 (28.4)	2,375 (29.9)	0.89
Calcium	528 (6.5)	519 (6.4)	527 (7.3)	514 (7.0)	0.20	511 (5.9)	522 (5.8)	526 (7.0)	508 (7.4)	0.87
Magnesium	241 (2.5)	239 (2.4)	242 (2.8)	238 (2.7)	0.62	224 (2.1)	230 (2.1)	232 (2.5)	225 (2.6)	0.60
Phosphate	944 (9.7)	936 (9.4)	948 (10.8)	935 (10.4)	0.64	877 (8.4)	896 (8.2)	904 (9.9)	876 (10.5)	0.81
Iron, g	8.0 (0.1)	8.0 (0.1)	8.0 (0.1)	8.0 (0.1)	0.96	8.0 (0.1)	8.0 (0.1)	8.0 (0.1)	8.0 (0.1)	0.18
Zinc	8.0 (0.1)	8.0 (0.1)	8.0 (0.1)	8.0 (0.1)	0.31	7.0 (0.1)	7.0 (0.1)	7.0 (0.1)	7.0 (0.1)	0.47
Copper	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	0.24	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	0.10
Manganese	6.0 (0.1)	6.0 (0.1)	6.0 (0.1)	6.6 (0.1)	<0.001	5.4 (0.1)	5.7 (0.1)	5.8 (0.1)	5.8 (0.1)	0.002
Vitamins, mg										
Retinol*, µg	601 (31.9)	577 (31.0)	594 (35.5)	668 (34.3)	0.13	533 (29.2)	597 (28.7)	587 (34.6)	579 (36.6)	0.32
Carotene, µg	3,238 (49.8)	3,155 (48.5)	3,253 (55.4)	3,129 (53.6)	0.24	3,389 (45.3)	3,439 (44.5)	3,451 (53.7)	3,296 (56.8)	0.29
Vitamin A, IU	1,185 (34.2)	1,150 (33.2)	1,185 (38.0)	1,242 (36.8)	0.20	1,138 (31.4)	1,214 (30.9)	1,208 (37.2)	1,176 (39.3)	0.42
Vitamin D	8.0 (0.1)	8.0 (0.1)	8.0 (0.2)	8.0 (0.2)	0.33	1.0 (0.1)	8.0 (0.1)	8.0 (0.2)	8.0 (0.2)	0.34
Vitamin E	5.0 (0.1)	5.0 (0.1)	5.0 (0.1)	5.0 (0.1)	0.07	5.0 (0.1)	5.0 (0.1)	5.0 (0.1)	5.0 (0.1)	0.32
Vitamin K	20.0 (2.9)	19.5 (2.8)	20.0 (3.2)	19.4 (3.1)	0.40	19.3 (2.6)	198 (2.5)	200 (3.1)	193 (3.2)	0.83
Vitamin B1	0.78 (0.0)	0.77 (0.0)	0.78 (0.0)	0.77 (0.0)	0.30	0.75 (0.0)	0.76 (0.0)	0.77 (0.0)	0.74 (0.0)	0.63
Vitamin B2	1.30 (0.0)	1.31 (0.0)	1.34 (0.0)	1.36 (0.0)	0.01	1.27 (0.0)	1.31 (0.0)	1.33 (0.0)	1.29 (0.0)	0.17
Niacin	13.5 (0.2)	13.5 (0.2)	13.6 (0.2)	13.7 (0.2)	0.42	12.7 (0.1)	13.2 (0.1)	13.3 (0.2)	12.9 (0.2)	0.33
Vitamin B6	1.10 (0.0)	1.10 (0.0)	1.11 (0.0)	1.10 (0.0)	0.94	1.07 (0.0)	1.09 (0.0)	1.10 (0.0)	1.07 (0.0)	0.68
Vitamin B12	8.3 (0.2)	8.1 (0.2)	8.0 (0.2)	8.2 (0.2)	0.52	7.3 (0.1)	7.7 (0.1)	7.8 (0.2)	7.5 (0.2)	0.14
Folic acid	430 (6.6)	433 (6.4)	443 (7.3)	452 (7.1)	0.02	409 (5.9)	42.9 (5.8)	434 (6.9)	428 (7.3)	0.02
Pantothenic acid	5.5 (0.1)	5.5 (0.1)	5.7 (0.1)	5.6 (0.1)	0.22	5.3 (0.1)	5.4 (0.1)	5.4 (0.1)	5.3 (0.1)	0.74
Vitamin C	126 (1.9)	127 (1.8)	129 (2.1)	130 (2.0)	0.13	132 (1.7)	135 (1.6)	136 (2.0)	134 (2.1)	0.37
Fat, g										
Saturated	9.9 (0.1)	9.7 (0.1)	9.9 (0.1)	9.8 (0.1)	0.69	9.8 (0.1)	10.0 (0.1)	9.9 (0.1)	9.5 (0.2)	0.25
Monounsaturated	10.4 (0.1)	10.3 (0.1)	10.3 (0.2)	10.2 (0.1)	0.33	10.1 (0.1)	10.3 (0.1)	10.3 (0.1)	9.9 (0.2)	0.30
Polyunsaturated	7.9 (0.1)	7.7 (0.1)	7.6 (0.1)	7.5 (0.1)	0.005	7.0 (0.1)	7.2 (0.1)	7.2 (0.1)	6.9 (0.1)	0.75
Cholesterol, mg	279 (4.2)	279 (4.1)	281 (4.6)	279 (4.5)	0.96	271 (3.9)	273 (3.8)	275 (4.6)	265 (4.8)	0.38
Dietary fiber, g										
Soluble	1.9 (0.0)	1.9 (0.0)	1.9 (0.0)	1.9 (0.0)	0.05	2.0 (0.0)	2.0 (0.0)	2.0 (0.0)	1.9 (0.0)	0.29
Insoluble	8.2 (0.1)	8.1 (0.1)	8.2 (0.1)	8.0 (0.1)	0.20	7.7 (0.1)	7.9 (0.1)	7.8 (0.1)	7.6 (0.1)	0.65
Total	11.1 (0.1)	11.0 (0.1)	11.1 (0.2)	10.7 (0.1)	0.09	10.7 (0.1)	10.9 (0.1)	10.9 (0.1)	10.5 (0.1)	0.58
Salt, g	6.0 (0.1)	5.9 (0.1)	5.6 (0.1)	5.5 (0.1)	<0.001	5.0 (0.1)	5.2 (0.1)	5.2 (0.1)	5.1 (0.1)	0.25
Animal fat, g	15.5 (0.2)	15.3 (0.2)	15.4 (0.3)	15.4 (0.3)	0.86	15.8 (0.2)	16.0 (0.2)	15.8 (0.3)	15.1 (0.3)	0.06
Fish fat, g	4.5 (0.1)	4.5 (0.1)	4.4 (0.1)	4.4 (0.1)	0.38	4.2 (0.1)	4.3 (0.1)	4.5 (0.1)	4.3 (0.1)	0.13
Vegetable oil, g	13.3 (0.2)	13.0 (0.2)	13.0 (0.2)	12.7 (0.2)	0.04	11.9 (0.2)	12.4 (0.2)	12.3 (0.2)	11.9 (0.2)	0.80

* equivalents

with intake of calcium for women.

Our study obtained consistent evidence on the associations of IGF-I and IGFBP-3 with calcium, which would provide potential mechanisms for the inter-relationships of IGF-I, IGFBP-3, calcium and lifestyle-related diseases.

An observational study of 89 western vegetarians and omnivores examined whether habitual diet was associated

with blood antioxidant status, including SOD activity (Haldar et al., 2007). That particular study showed that SOD activity was associated with higher intakes of cruciferous vegetables, berries and zinc, and lower intakes of flour and grain products, potatoes, mushrooms, citrus fruits, fiber, magnesium and selenium. Similar associations with SOD activity were found in the present study: for example, rice and magnesium for both men and

women, and potatoes and citrus fruits for women.

In the present study, we further found that IGF-II levels were associated with higher intakes of milk, yogurt, fruits and miso soup, and lower intakes of rice, coffee and carbohydrate; TGF- β 1 levels were associated with lower intake of coffee, and higher intakes of miso soup and sodium, and sFas levels were associated with higher intake of folic acids for both men and women. However, few studies have examined whether cancer-related biomarkers, such as IGF-II, TGF- β 1 and sFas levels are associated with diets.

There are several limitations in the present study. It was conducted with a cross-sectional design and we did not analyze the associations by adjustment for potential confounding factors. Additionally, the number of food items in our FFQ was smaller than in previous observational studies (Devine et al. 1998; Holmes et al. 2002; Giovannucci et al. 2003; Gunnell et al. 2003; DeLellis et al., 2004; Larsson et al., 2005; McGreevy et al., 2007; Norat et al., 2007; Crowe et al. 2009), and some foods and nutrients were not be estimated by our FFQ. There are subtypes of cereals (bread, noodle and the other flour and grain products) and subtypes of protein (animal, dairy and vegetable) which have been associated with certain cancer-related biomarkers in previous studies (Devine et al., 1998; Holmes et al., 2002; Giovannucci et al., 2003; Haldar et al., 2007; Crowe et al., 2009).

Therefore, further investigation for diet-biomarkers associations, especially protein intake will be conducted in the future. For the moment, the results in the present study should help in interpreting findings for biomarkers linked with risk of cancer and other lifestyle-related diseases in terms of confounding as causality.

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