Table 2
Selected characteristics of subjects by quartiles of energy-adjusted intakes of calcium and dairy products (n = 1905)*

Variable	Quartiles of intakes of calcium or dairy products				$P^{\dagger}$
	1 (n = 476)	2 (n = 476)	3 (n = 477)	4 (n = 476)	
Calcium intake (mg/1000 kcal)	166 ± 26	227 ± 15	283 ± 17	394 ± 74	
Current smokers (%)	4	2	3	2	0.27
Current alcohol drinkers (%)	19	22	19	23	0.26
Subjects with active lifestyle (%)	9	15	14	16	0.0019
Subjects with experience of dieting (%)	36	36	43	42	0.0061
Intentional dietary change (%)					<0.0001
No	87	81	77	66	
Changed within 1 y	8	10	11	16	
Changed within 3 y	3	6	8	10	
Changed >3 y ago	2	3	4	8	
Rate of eating (%)					0.0073
Very slow	3	5	4	7	
Relatively slow	21	22	23	24	
Medium	38	33	37	35	
Relatively fast	31	36	31	29	
Very fast	7	3	5	4	
Protein intake (% energy)	12.1 ± 1.9	13.2 ± 1.7	14.1 ± 1.8	15.2 ± 2.1	<0.0001
Fat intake (% energy)	28.4 ± 6.9	31.1 ± 5.7	31.2 ± 5.6	31.1 ± 5.5	<0.0001
Dietary fiber intake (g/1000 kcal)	5.4 ± 1.2	6.0 ± 1.3	6.7 ± 1.5	7.2 ± 2.0	<0.0001
Dairy product intake (g/1000 kcal)	19 ± 8	49 ± 10	86 ± 12	166 ± 59	
Current smokers (%)	3	3	3	3	0.71
Current alcohol drinkers (%)	18	20	23	21	0.14
Subjects with active lifestyle (%)	10	14	14	16	0.0197
Subjects with experience of dieting (%)	40	37	38	42	0.42
Intentional dietary change (%)					<0.0001
No	83	79	80	69	
Changed within 1 y	9	12	9	15	
Changed within 3 y	6	4	6	10	
Changed >3 y ago	3	5	4	6	
Rate of eating (%)					0.14
Very slow	3	5	6	6	
Relatively slow	22	24	21	23	
Medium	39	34	33	38	
Relatively fast	31	33	35	30	
Very fast	6	4	5	4	
Protein intake (% energy)	12.8 ± 2.1	13.5 ± 2.1	13.8 ± 2.1	14.6 ± 2.1	<0.0001
Fat intake (% energy)	28.7 ± 6.6	30.6 ± 6.4	31.5 ± 5.2	31.1 ± 5.6	<0.0001
Dietary fiber intake (g/1000 kcal)	6.1 ± 1.6	6.3 ± 1.7	6.4 ± 1.6	6.5 ± 1.8	0.0045

* Values are mean ± standard deviation unless otherwise indicated.
† For continuous variables, tests for linear trend used the median value in each quartile as a continuous variable in linear regression; a Mantel-Haenszel chi-square test was used for categorical variables.

of American adolescents has also suggested a positive association between milk intake and body weight gain [22]. These inconsistent results may be explained at least in part by the different populations examined, different methods used to assess obesity and dietary intake, and number and type of variables used as confounding factors.

A possible reason for the null association we observed may be due to the narrow BMI range of our subjects, 78% of whom were of normal weight (BMI 18.5 to 24.9 kg/m^2) and only 6% were overweight (BMI ≥ 25 kg/m^2); thus, our population is relatively lean compared with populations in Western countries. Alternatively, it is possible that intakes of calcium and dairy products in our population were too low to have a beneficial effect on BMI; even intake levels of the highest quartile categories were relatively low for calcium (median 373 mg/1000 kcal) and dairy products (141 g/1000 kcal).

We do not believe that our null finding is due to any inaccuracy of our data for the following reasons. First, we used a validated DHQ to assess dietary intake. Second, although we used BMI computed from self-reported rather than measured weight and height, previous research has shown that BMI derived from the former is highly correlated with measured BMI [34,35], suggesting that BMI thus calculated is a reliable measurement for use in correlation analysis. Third, we previously observed a significant association of the self-reported rate of eating and dietary fiber intake with BMI in the same population [26], which may be some evidence of the quality of our data. Fourth, we conducted analyses with and without 481 women with implau-

Table 3
Adjusted mean ± SE of BMI according to quartiles of energy-adjusted intakes of calcium and dairy products with partial regression coefficients (β) and SE expressing changes in BMI for change in energy-adjusted intakes of calcium and dairy products (n = 1905)*

Variable	Quartiles of intakes of calcium or dairy products‡				P for trend†	$\beta \pm$ SE	P
	1 (n = 476)	2 (n = 476)	3 (n = 477)	4 (n = 476)			
Calcium intake (mg/1000 kcal)	170 (74–201)	227 (202–254)	282 (255–314)	373 (315–728)			
BMI (kg/m^2)	20.7 ± 0.1	20.7 ± 0.1	20.9 ± 0.1	20.8 ± 0.1	0.48	−0.0002 ± 0.0008	0.77
Dairy product intake (g/1000 kcal)	19 (0–32)	49 (33–65)	86 (66–108)	141 (109–458)			
BMI (kg/m^2)	20.6 ± 0.1	20.8 ± 0.1	21.1 ± 0.1	20.6 ± 0.1	0.81	−0.0004 ± 0.0001	0.71

BMI, body mass index; SE, standard error

* Adjusted for residential block (Kanto II, Hokkaido, and Tohoku; Kanto I; Tokai and Hokuriku; Kinki I; Kinki II; Chugoku; Shikoku; Kita-kyushu; and Minami-kyushu), size of residential area (city with population ≥ 1 million, city with population < 1 million, and town and village), current smoking (yes or no), alcohol drinking (yes or no), physical activity (sedentary or active), experience of dieting (yes or no), intentional dietary change (no, changed within 1 y, changed within 3 y, or changed >3 y ago), rate of eating (very slow, relatively slow, medium, relatively fast, or very fast), protein intake (percentage of energy, continuous), fat intake (percentage of energy, continuous), and dietary fiber intake (grams per 1000 kcal, continuous).

† Tests for linear trend used the median value in each quartile as a continuous variable in linear regression.

‡ Values are medians (ranges) or means ± SE.

sible energy intake, and these analyses provided similar results.

We could not include calcium intake from dietary supplements in the analysis because of the lack of a reliable composition table of dietary supplement in Japan. However, only 37 of 1905 women (2%) used calcium supplement in the present study. In addition, neither exclusion of calcium supplement users from analysis nor a further adjustment for calcium supplement usage as a dummy variable (yes or no) materially altered the results (data not shown). Thus, it is hardly likely that calcium supplement usage had a major effect on the findings in this study.

Our results may not be extrapolated to general Japanese populations because the subjects were selected female dietetic students who may have been highly health conscious. Other limitations regarding subject characteristics include the narrow range of age (18 to 20 y) and BMI (78% of subjects had a normal BMI, i.e., 18.5 to 24.9 kg/m^2) and the relatively low intakes of calcium and dairy products mentioned above. Possible seasonal changes in dietary habits were not taken into account in the present study because our DHQ assessed dietary habits during the previous month; however, seasonal variations in Japanese women seemed to be relatively minor, at least in calcium intake (7%) [36]. Although we attempted to adjust for a wide range of potential confounding variables, we can not rule out the possibility of residual confounding due to these or poorly measured variables such as physical activity, which was assessed quite roughly, and other unmeasured variables such as parental overweight or obesity, socioeconomic level, and unknown variables.

In conclusion, intakes of calcium and dairy products may not necessarily be associated with BMI among young Japanese women who not only are relatively lean but also have relatively low intakes of calcium and dairy products. However, better-designed cross-sectional studies and prospective and intervention studies should be conducted to confirm our present findings.

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ORIGINAL ARTICLE

Dietary intake in relation to self-reported constipation among Japanese women aged 18–20 years

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Objective: Information on modifiable lifestyle factors associated with constipation is limited, especially among non-Western populations. We examined associations between dietary intake and self-reported constipation in young Japanese women.
Design: Cross-sectional study.
Subjects: A total of 1705 female Japanese dietetic students aged 18–20 years and free of current disease and current dietary counseling.
Methods: Dietary intake was estimated over a 1-month period with a validated, self-administered, diet history questionnaire, and lifestyle variables including self-reported constipation were assessed by a second questionnaire designed for this survey.
Results: A total of 436 women (26%) reported themselves to be 'constipated'. A multivariate odds ratio (OR) for women in the highest quartile of rice intake was 0.47 (95% confidence interval (CI): 0.33, 0.68) compared with the lowest. Additionally, women in the highest category of coffee intake had a multivariate OR of 0.67 (0.47, 0.94) compared with women in the lowest. Conversely, women in the highest quartile of confectionery intake had a multivariate OR of 1.54 (1.12, 2.13) compared with women in the lowest. Moreover, a multivariate OR for constipation for women in the highest quartile of Japanese and Chinese tea intake was 1.49 (1.09, 2.05) compared with women in the lowest. Neither total dietary fiber intake nor other lifestyle factors examined were associated with constipation.
Conclusions: The consumption of rice and coffee was inversely associated with and that of confectioneries and Japanese and Chinese tea was positively associated with a prevalence of self-reported constipation.
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Keywords: dietary intake; constipation; Japanese women

Introduction

Constipation is a major health problem, although the criteria for constipation remain arbitrary (Thompson *et al.*, 1999), and symptoms of constipation vary from a relatively mild bowel habit disturbance to rare serious sequelae (Talley *et al.*, 2003). The reported prevalence of constipation ranges from 2 to 30% in Western countries, depending on the definition applied (Garrigues *et al.*, 2004; Higgins and Johanson, 2004). In Japan, the prevalence of constipation, defined as ⩽3 bowel movements weekly, also seems to be relatively high (6–25%) (Hirai and Takezoe, 1997; Hirai *et al.*, 2001). As a result of its high prevalence, chronic nature and effect on quality of life (Talley, 2004), modifiable lifestyle factors associated with constipation need to be identified.

According to previous studies in the West, not only various factors including age (Everhart *et al.*, 1989; Sandler *et al.*, 1990; Campbell *et al.*, 1993; Dukas *et al.*, 2003), sex (Everhart *et al.*, 1989; Sandler *et al.*, 1990; Campbell *et al.*, 1993), smoking status (Dukas *et al.*, 2003), alcohol consumption (Dukas *et al.*, 2003; Sanjoaquin *et al.*, 2004), body mass index (BMI) (Sandler *et al.*, 1990; Dukas *et al.*, 2003; Sanjoaquin *et al.*, 2004), and physical activity (Everhart *et al.*, 1989;

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Sandler et al., 1990; Dukas et al., 2003; Sanjoaquin et al., 2004), but also several aspects of diet such as intakes of energy (Sandler et al., 1990; Towers et al., 1994), dietary fiber (Dukas et al., 2003; Sanjoaquin et al., 2004), and nonalcoholic beverages (Sandler et al., 1990; Sanjoaquin et al., 2004) have been associated with constipation. However, information on this issue is quite limited among people in Asian countries including Japan (Kunimoto et al., 1998; Wong et al., 1999; Nakaji et al., 2002; Fujiwara, 2003), where dietary habits and foods available differ considerably from those in Western countries. Moreover, quantitative assessment of diet was not performed in these Asian studies. Therefore, we investigated associations of dietary factors, which were assessed using a previously-validated self-administered diet history questionnaire (DHQ) (Sasaki et al., 1998a, b; 2000b), as well as other lifestyle factors with self-reported constipation in young Japanese women.

Subjects and methods

Subjects and data collection
The subjects were students who entered dietetic courses at 22 colleges and technical schools in Japan in April 1997 (n = 2069) (Sasaki et al., 2002; 2000a; 2003a). A total of 2063 students (2017 women and 46 men) participated in the survey (response rate: 99.7%). The staff of each school checked the submitted questionnaires according to the survey protocol. When missing values and/or logical errors were detected, the subjects were asked to complete the questions again. The questionnaires were checked at least once by the staff at each school and by the staff at the survey center. Most surveys were completed by the end of May 1997.

Questionnaires
Data were collected using the following two questionnaires: DHQ and a questionnaire on general lifestyle. The DHQ is a previously validated, structured 16-page questionnaire for assessing dietary habits in the previous month, consisting of the following seven sections: overall dietary behaviors; major cooking methods; consumption frequency and amount of six alcoholic beverages; consumption frequency and semi-quantitative portion size of selected 121 food and nonalcoholic beverage items; dietary supplement; consumption frequency and amount of 19 staple foods (rice, bread and noodles) and miso-soup; and open-ended sections for foods consumed regularly ($\geq$once/week) but not appearing in the DHQ (Sasaki et al., 1998a, b; 2000b). The food and beverage items and their portion sizes in the DHQ were derived mainly from the data of the National Nutrition Survey of Japan (Ministry of Health and Welfare, 1994). Dietary intake, including 147 food and beverage items, energy and dietary fiber, was calculated using an *ad hoc* algorithm for the DHQ, which was based on the food composition table in Japan (Science and Technology Agency, 2000); information on dietary supplement and from the open-ended section is not used in the calculation. Dietary fiber intake was estimated by the modified Prosky method (Science and Technology Agency, 2000) from the intake of 86 fiber-containing foods in the DHQ. The food and nonalcoholic beverage items were grouped into the following 18 food groups: rice; bread; noodles; potatoes; confectioneries (including sugar and sweeteners); fat and oil; pulses (including nuts); fish and shellfish; meat; eggs; dairy products; vegetables (including mushrooms and sea vegetables); fruits; water; Japanese and Chinese tea (nonfermented type of tea (green tea) and semi-fermented type of tea (oolong tea)); black tea (fermented type of tea); coffee; other nonalcoholic beverages. A detailed description and methods of calculating dietary intake and the validity of the DHQ have been published elsewhere (Sasaki et al., 1998a). The Pearson correlation coefficient between the DHQ and 3-d dietary records was 0.48 for energy intake among 47 women (Sasaki et al., 1998a). For dietary fiber intake (g/1000 kcal), the Pearson correlation coefficient between DHQ and 16-d dietary records was 0.69 among 92 women; the mean value of the Spearman correlation coefficients for intakes of 16 food groups (g/1000 kcal) was 0.35 (range: 0.05–0.59) (unpublished observations, Sasaki, 2004).

Body weight and height were self-reported as part of the DHQ. BMI was computed as weight (kg) divided by square of height (m). We classified BMI into three categories (<18.5, 18.5–24.9, and ≥ 25) according to the Japan Society for the Study of Obesity (Matsuzawa et al., 2000). The subjects were also asked in the DHQ whether they currently received dietary counseling.

The questionnaire on general lifestyle during the previous month is a 4-page questionnaire designed for this survey. In this questionnaire, subjects reported residential area (a place where the subject mainly lived during the previous month), participation in sports club activities (times/months), without inquiring into the types of sports, their intensity or duration, and smoking status ('never,' 'past' or 'current'). They were also asked whether or not they were currently suffering from some diseases. Residential areas were categorized into 12 blocks according to the National Nutrition Survey in Japan (Ministry of Health and Welfare, 2004). Since relatively few subjects were categorized into three of these blocks, they were included in their neighboring blocks. The residential areas were also divided into three categories according to population size (cities with population ≥ 1 million, cities with population <1 million, and towns and villages). The subjects who participated in sport club activities at least once per week were regarded as 'active' and all others as 'sedentary'.

Constipation was assessed by the following question in the questionnaire: do you often have constipation? The possible answers were 'yes', 'sometimes', or 'no'. The subjects with an answer of *yes* to the question were considered to be 'constipated'. We examined the validity of this question in

145 female Japanese dietetic students (mean age: 21.2 years) using 14-d bowel movement diaries as the standard; 33 subjects with an answer of *yes* had significantly ($P<0.001$) fewer bowel movements (mean±s.d.: 3.4±1.1 day/week) than did 60 subjects with an answer of *sometimes* (4.5±1.3 day/week) or 52 subjects with an answer of *no* (6.2±1.0 day/week).

Statistical analysis

For statistical analysis, we selected female subjects aged 18–20 years ($n=1960$). We excluded one woman whose residential area was not in Japan, 154 women currently having some diseases, and 33 women currently receiving dietary counseling. Also excluded were 43 women with a reported energy intake less than half the energy requirement for the lowest physical activity category (<775 (1550 × 0.5) kcal/day) or a reported energy intake more than 1.5 times the energy requirement of the highest physical activity category (>3450 (2300 × 1.5) kcal/day) according to the Recommended Dietary Allowance for Japanese (Ministry of Health and Welfare, 1999). We further excluded 47 women with missing values in the variables used. A total of 1705 women remained for the present analysis; some women were in more than one exclusion category.

The association between self-reported constipation (the dependent variable) and a number of variables was examined. The variables examined were six nondietary variables, that is, residential blocks (nine categories), size of residential area (three categories), physical activity (two categories), smoking status (three categories), alcohol drinking habits (two categories ('yes' or 'no') because of extremely low alcohol intake (mean: 0.7 g/day)), and BMI (three categories) and 22 dietary variables, that is, intakes of energy (kcal/day), 18 food groups mentioned above (g/1000 kcal), and total, soluble, and insoluble dietary fiber (g/1000 kcal) (quartiles except for water (four categories), black tea (four categories), and coffee (three categories) because of more than one quarter nonconsumers). We calculated both crude and multivariate odds ratios (ORs) and 95% CIs for self-reported constipation for each category of variables included using the logistic regression analysis; multivariate ORs were calculated by adjusting for six nondietary variables and energy intake. As results for the crude and multivariate analyses were similar for all variables considered, we presented only the results derived from the multivariate models. Trend of association (for only dietary variables) was assessed by a logistic regression model assigning scores to the levels of the independent variable. All statistical analyses were performed using the SPSS for Windows software program, version 11.5, (SPSS Japan Inc.) and the SAS statistical software, version 8.2 (SAS Institute Inc.). A two-sided P value of <0.05 was considered statistically significant.

Results

The mean (±s.d.) of selected physical characteristics was as follows: 18.1±0.4 years for age, 157.9±5.2 cm for height, 51.8±7.3 kg for weight, and 20.8±2.6 kg/m^2 for BMI. A total of 436 (26%) out of 1705 women reported themselves to be 'constipated'. Table 1 presents the multivariate ORs (95% CIs) for constipation in each category of selected demographic and lifestyle factors. Living in town or village was associated with a decreased prevalence of constipation compared with living in city with population ⩾1 million (OR: 0.64; 95% CI: 0.43, 0.97). Residential block, physical activity, smoking status, alcohol drinking habits, and BMI were not significantly associated with constipation.

Table 1 Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for self-reported constipation in relation to selected demographic and lifestyle factors among 1705 Japanese women aged 18–20 years

	n with/without constipation	*Adjusted OR[a] (95% CI)*
Residential block[b]		
Kanto II, Hokkaido, Tohoku	21/56	1.00
Kanto I	97/282	0.75 (0.41, 1.34)
Tokai, Hokuriku	74/173	1.06 (0.60, 1.89)
Kinki I	32/103	0.71 (0.36, 1.37)
Kinki II	31/73	1.07 (0.55, 2.06)
Chugoku	52/219	0.61 (0.33, 1.10)
Shikoku	27/115	0.59 (0.31, 1.15)
Kita-kyushu	58/127	1.16 (0.64, 2.10)
Minami-kyushu	44/121	0.95 (0.51, 1.76)
Size of residential area		
City with population ⩾1 million	81/202	1.00
City with population <1 million	258/723	0.83 (0.59, 1.17)
Town and village	97/344	0.64 (0.43, 0.97)
Physical activity[c]		
Sedentary	385/1113	1.00
Active	51/156	0.94 (0.66, 1.32)
Smoking status		
Nonsmoker	402/1197	1.00
Past smoker	15/39	1.18 (0.63, 2.21)
Currrent smoker	19/33	1.79 (0.98, 3.26)
Alcoholdrinking habits		
Nondrinker	345/991	1.00
Drinker	91/278	0.87 (0.66, 1.15)
Body mass index (kg/m^2)		
<18.5	69/215	1.00
18.5–24.9	351/971	1.15 (0.85, 1.55)
⩾25	16/83	0.62 (0.34, 1.13)

[a]OR adjusted for residential block, size of residential area, physical activity, smoking status, alcohol drinking habits, body mass index, and energy intake.
[b]The residential blocks were categorized into 12 blocks according to the National Nutrition Survey of Japan (Ministry of Health and Welfare, 2004). As the subjects categorized into three of these blocks (Hokkaido, Tohoku, and Hokuriku) were relatively few, they were included in their neighboring regions.
[c]The subjects who took part in sports club activity at least once per week were defined as 'active' and others as 'sedentary'.

Table 2 shows the associations between dietary intake and constipation. Energy intake was not associated with a prevalence of constipation. There was a clear dose-response relationship between increased intake of rice and a decreased

Table 2 Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for self-reported constipation in relation to intakes of energy, dietary fiber, and food groups among 1705 Japanese women aged 18–20 years

	n with/without constipation	Adjusted OR[a] (95% CI)
Energy intake (kcal/day)		
1365 (777–1554)[b]	113/313	1.00
1703 (1555–1833)	105/321	0.94 (0.68, 1.28)
1977 (1834–2154)	100/327	0.87 (0.63, 1.19)
2447 (2155–3339)	118/308	1.12 (0.82, 1.53)
P for trend		0.58
Food intake (g/1000 kcal)		
Rice		
82.9 (0–104.9)	131/295	1.00
124.3 (105.0–144.3)	129/297	0.98 (0.72, 1.32)
164.3 (144.4–186.4)	97/330	0.65 (0.47, 0.90)
221.0 (186.5–441.8)	79/347	0.46 (0.32, 0.66)
P for trend		<0.0001
Bread		
8.5 (0–15.0)	95/331	1.00
21.8 (15.1–27.6)	111/315	1.20 (0.87, 1.65)
35.3 (27.7–43.5)	113/314	1.23 (0.89, 1.69)
59.5 (43.6–180.5)	117/309	1.27 (0.93, 1.75)
P for trend		0.15
Noodles		
0 (0–13.4)	117/309	1.00
22.0 (13.5–29.5)	110/316	0.91 (0.67, 1.23)
38.4 (29.6–50.3)	108/319	0.87 (0.63, 1.18)
67.4 (50.4–208.0)	101/325	0.81 (0.59, 1.11)
P for trend		0.19
Potatoes		
7.7 (0–10.1)	97/329	1.00
12.3 (10.2–14.4)	112/315	1.19 (0.87, 1.64)
17.0 (14.5–21.2)	111/315	1.18 (0.86, 1.63)
28.1 (21.3–99.0)	116/310	1.23 (0.90, 1.69)
P for trend		0.24
Confectioneries[c]		
16.9 (0.6–23.3)	95/331	1.00
29.5 (23.4–35.6)	84/342	0.86 (0.61, 1.20)
41.9 (35.7–49.3)	127/300	1.47 (1.07, 2.02)
60.6 (49.4–159.6)	130/296	1.56 (1.13, 2.14)
P for trend		<0.001
Fat and oil		
6.3 (0.8–8.4)	124/302	1.00
10.2 (8.5–11.8)	109/317	0.83 (0.61, 1.13)
13.8 (11.9–15.9)	93/334	0.72 (0.52, 0.98)
19.6 (16.0–68.4)	110/316	0.86 (0.63, 1.17)
P for trend		0.23
Pulses[d]		
8.8 (0–12.8)	114/312	1.00
16.9 (12.9–21.1)	95/331	0.76 (0.55, 1.05)
26.2 (21.2–33.5)	119/308	1.02 (0.74, 1.39)
43.9 (33.6–119.6)	108/318	0.93 (0.68, 1.27)
P for trend		0.94

Table 2 *Continued*

	n with/without constipation	Adjusted OR[a] (95% CI)
Fish and shellfish		
15.8 (0–21.7)	111/314	1.00
27.2 (21.8–31.6)	103/324	0.93 (0.68, 1.28)
26.5 (31.7–43.0)	107/320	0.97 (0.71, 1.33)
55.1 (43.1–229.1)	115/311	1.12 (0.81, 1.53)
P for trend		0.48
Meats		
17.2 (0–22.2)	114/311	1.00
26.9 (22.3–31.4)	108/320	0.94 (0.69, 1.28)
36.6 (31.5–42.7)	108/318	0.92 (0.67, 1.26)
52.9 (42.8–117.5)	106/320	0.91 (0.66, 1.25)
P for trend		0.55
Eggs		
3.1 (0–8.0)	106/320	1.00
12.9 (8.1–17.3)	99/327	0.92 (0.67, 1.27)
22.9 (17.4–27.3)	113/313	1.10 (0.80, 1.52)
33.3 (27.4–114.3)	118/309	1.24 (0.90, 1.70)
P for trend		0.11
Dairy products		
18.6 (0–32.3)	98/328	1.00
48.7 (32.4–65.6)	123/303	1.37 (1.00, 1.88)
85.3 (65.7–109.1)	111/316	1.23 (0.89, 1.70)
140.6 (109.2–457.7)	104/322	1.05 (0.76, 1.45)
P for trend		0.99
Vegetables[e]		
52.0 (2.1–69.9)	117/309	1.00
84.9 (70.0–100.4)	100/326	0.86 (0.63, 1.18)
117.6 (100.5–139.9)	109/318	0.96 (0.70, 1.31)
176.8 (140.0–457.9)	110/316	0.97 (0.71, 1.33)
P for trend		0.95
Fruits		
14.3 (0–24.5)	118/308	1.00
34.5 (24.6–44.6)	101/325	0.80 (0.58, 1.09)
56.8 (44.7–72.6)	105/322	0.85 (0.62, 1.17)
99.5 (72.7–695.7)	112/314	0.95 (0.69, 1.29)
P for trend		0.84
Water		
0 (0)	160/504	1.00
11.5 (2.6–17.2)	56/132	1.31 (0.91, 1.89)
45.4 (17.3–83.0)	109/318	1.11 (0.83, 1.49)
181.2 (83.1–1836.0)	111/315	1.12 (0.84, 1.50)
P for trend		0.45
Japanese and Chinese tea[f]		
47.8 (0–86.2)	100/326	1.00
141.6 (86.3–201.1)	96/330	0.92 (0.66, 1.27)
248.1 (201.2–313.3)	105/322	1.09 (0.79, 1.50)
432.9 (313.4–1471.1)	135/291	1.54 (1.12, 2.11)
P for trend		0.004
Black tea[g]		
0 (0)	115/379	1.00
12.3 (5.4–18.9)	83/275	0.98 (0.71, 1.36)
31.2 (19.0–49.2)	120/307	1.37 (1.01, 1.85)
78.2 (49.3–871.7)	112/314	1.17 (0.86, 1.61)
P for trend		0.11

Table 2 *Continued*

	n with/without constipation	Adjusted OR[a] (95% CI)
Coffee		
0 (0)	240/748	1.00
13.1 (4.7–27.3)	66/225	0.74 (0.58, 0.96)
66.0 (27.4–604.7)	130/296	0.66 (0.47, 0.94)
P for trend		0.045
Other nonalcoholic beverages		
0 (0–4.3)	108/318	1.00
14.3 (4.4–25.3)	118/308	1.11 (0.81, 1.51)
38.6 (25.4–55.9)	102/325	0.92 (0.67, 1.27)
92.7 (56.0–698.0)	108/318	1.03 (0.75, 1.41)
P for trend		0.83
Total dietary fiber intake (g/1000 kcal)		
4.6 (2.6–5.1)	97/326	1.00
5.7 (5.2–6.1)	110/321	1.14 (0.83, 1.57)
6.6 (6.2–7.2)	109/317	1.17 (0.85, 1.62)
8.1 (7.3–14.3)	120/305	1.36 (0.98, 1.87)
P for trend		0.07
Soluble dietary fiber intake (g/1000 kcal)		
1.1 (0.5–1.2)	94/332	1.00
1.5 (1.3–1.5)	110/316	1.22 (0.89, 1.68)
1.7 (1.6–1.8)	102/325	1.10 (0.79, 1.52)
2.1 (1.9–4.5)	130/296	1.60 (1.16, 2.21)
P for trend		0.01
Insoluble dietary fiber intake (g/1000 kcal)		
3.4 (1.8–3.7)	101/325	1.00
4.1 (3.8–4.3)	112/314	1.12 (0.82, 1.53)
4.8 (4.4–5.2)	105/322	1.05 (0.76, 1.45)
5.9 (5.3–10.9)	118/308	1.27 (0.92, 1.75)
P for trend		0.21

[a]OR adjusted for residential block, size of residential area, physical activity, smoking status, alcohol drinking habits, and body mass index. For intakes of dietary fiber and food groups, further adjusted for energy intake.
[b]Median (range).
[c]Including sugar and sweeteners.
[d]Including nuts.
[e]Including mushrooms and sea vegetables.
[f]Non- and semifermented tea.
[g]Fermented tea.

Table 3 Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for self-reported constipation in relation to intakes of selected food groups (further adjusted for intake of total dietary fiber) and total dietary fiber (further adjusted for intake of rice) among 1705 Japanese women aged 18–20 years

	n with/without constipation	Adjusted OR[a] (95% CI)
Food intake (g/1000 kcal)		
Rice[b]		
82.7 (0–104.6)[c]	131/295	1.00
123.9 (104.7–144.1)	129/297	0.99 (0.73, 1.33)
163.7 (144.2–185.8)	97/330	0.66 (0.48, 0.91)
220.3 (185.9–440.5)	79/347	0.47 (0.33, 0.68)
P for trend		<0.0001
Confectioneries[b]		
16.7 (0.6–23.1)	95/331	1.00
29.1 (23.2–35.1)	84/342	0.86 (0.61, 1.21)
41.2 (35.2–48.6)	127/300	1.47 (1.07, 2.03)
59.9 (48.7–157.6)	130/296	1.54 (1.12, 2.13)
P for trend		0.0005
Japanese and Chinese tea[d]		
47.8 (0–86.2)	100/326	1.00
141.6 (86.3–201.1)	96/330	0.89 (0.64, 1.23)
248.1 (201.2–313.3)	105/322	1.05 (0.76, 1.45)
432.9 (313.4–1471.1)	135/291	1.49 (1.09, 2.05)
P for trend		0.0067
Coffee		
0 (0)	240/748	1.00
13.1 (4.7–27.3)	66/225	0.75 (0.58, 0.97)
66.0 (27.4–604.7)	130/296	0.67 (0.47, 0.94)
P for trend		0.0563
Total dietary fiber intake (g/1000 kcal)		
4.6 (2.6–5.1)	97/326	1.00
5.7 (5.2–6.1)	110/321	1.03 (0.75, 1.43)
6.6 (6.2–7.2)	109/317	1.01 (0.72, 1.40)
8.1 (7.3–14.3)	120/305	1.16 (0.84, 1.62)
P for trend		0.41

[a]OR adjusted for residential block, size of residential area, physical activity, smoking status, alcohol drinking habits, body mass index, and energy intake. For intakes of food groups, further adjusted for total dietary fiber intake and for total dietary fiber intake, further adjusted for intake of rice (excluding dietary fiber content).
[b]Excluding dietary fiber content.
[c]Median (range).
[d]Non- and semifermented tea.

prevalence of constipation (P for trend <0.0001). Women in the highest quartile had a multivariate OR of 0.46 (95% CI: 0.32, 0.66) compared with women in the lowest. Other staple foods including bread and noodles were not associated with prevalence of constipation. Because only staple foods were assessed for each meal separately in DHQ, we further assessed the relationships of intakes of rice from each meal with constipation. Increased intakes of rice at breakfast, lunch, and dinner were all associated with a decreased prevalence of constipation (multivariate OR (95% CI) in the highest quartile compared with the lowest: 0.62 (0.44, 0.86) for breakfast (P for trend $=0.002$); 0.65 (0.46, 0.91) for lunch (P for trend $=0.001$); 0.55 (0.39, 0.78) for dinner (P for trend $=0.001$)).

The prevalence of constipation increased with increasing intake of confectioneries (P for trend <0.001). In comparison with women in the lowest quartile, the multivariate OR for women in the highest was 1.56 (95% CI: 1.13, 2.14). There was also a positive association between intake of Japanese and Chinese tea and a prevalence of constipation (P for trend $=0.004$). Women in the highest quartile of the intake had a multivariate OR of 1.54 (95% CI: 1.12, 2.11) compared with those in the lowest. On the other hand, there was an inverse association between coffee intake and a prevalence of constipation (P for trend $=0.045$). Women in the highest category of the intake had a multivariate OR of 0.66 (95% CI: 0.47, 0.94) compared with those in the lowest. No clear associations were observed between constipation and the intake of other food groups examined. As shown in

Table 3, further adjustment for total dietary fiber, as well as soluble and insoluble dietary fiber (data not shown), did not change the results of rice (excluding dietary fiber content) (P for trend <0.0001), confectioneries (excluding dietary fiber content) (P for trend $= 0.0005$), Japanese and Chinese tea (P for trend $= 0.0067$), and coffee (P for trend $= 0.0563$) materially, indicating that these observed associations are independent of dietary fiber intake.

There was a positive association of intake of total and soluble dietary fiber with a prevalence of constipation (P for trend $= 0.07$ and 0.01, respectively). The association between total dietary fiber and constipation, however, disappeared when further adjusted for rice (excluding dietary fiber content) (P for trend $= 0.41$; Table 3), confectioneries (excluding dietary fiber content) (P for trend $= 0.16$), Japanese and Chinese tea (P for trend $= 0.09$), or coffee (P for trend $= 0.09$). Additionally, although the positive association between soluble dietary fiber and constipation remained when further adjusted for Japanese and Chinese tea (P for trend $= 0.01$) or coffee (P for trend $= 0.02$), the association disappeared when further adjusted for rice (excluding dietary fiber content) (P for trend $= 0.37$) or confectioneries (excluding dietary fiber content) (P for trend $= 0.08$). Thus, the positive association between dietary fiber and constipation seemed to be largely dependent on rice intake.

Discussion

We found that increased intakes of rice and coffee were associated with a decreased risk of constipation in young Japanese women. We also found that lower intakes of confectioneries and Japanese and Chinese tea were associated with a decreased risk of constipation. While a limited number of studies on this issue conducted in Asian countries used non-validated, relatively simple questionnaires for the assessment of dietary factors (Kunimoto *et al.*, 1998; Wong *et al.*, 1999; Nakaji *et al.*, 2002; Fujiwara, 2003), we used a previously validated DHQ for quantitative assessment of dietary intake.

We found dose–response relationships of increased intake of rice with a decreased risk of constipation. Furthermore, increased intakes of rice from breakfast, lunch, and dinner were all associated with decreased risk of constipation. The protective effect of rice on constipation has also been indicated in two previous studies conducted in Asian communities (Wong *et al.*, 1999; Nakaji *et al.*, 2002) where rice is the main staple food. The reason for the association is not well known. Nakaji *et al.* (2002) hypothesized that the effect of rice is due to dietary fiber in rice because rice is the largest source of dietary fiber in Japanese people (Sasaki *et al.*, 2003b). Conversely, Wong *et al.* (1999) hypothesized that the effect of rice is explained by the increased energy intake because rice is high in energy but low in fiber. In these studies, however, quantitative assessment of dietary intake was not available because of the use of relatively simple questionnaire. Our data do not support their hypotheses since the association between rice and constipation was independent of both energy and dietary fiber intake. Rice is a staple food in Japan and a major contributor of many vitamins and minerals; some of constituents in rice and/or combinations of these constituents might exert a preventive effect on constipation. Alternatively, rice intake might merely reflect an overall healthier lifestyle that may not have been accurately captured and controlled in our analysis.

Several studies have suggested the association of breakfast-skipping and constipation (Kunimoto *et al.*, 1998; Fujiwara, 2003), but we did not assess this association because of a quite small number of women with the habit of breakfast-skipping ($n = 30$). In the present study, however, 65% of the staple food intake at breakfast was derived from rice, while a decreased intake of rice at breakfast was associated with increased risk of constipation. This might suggest breakfast-skipping as a risk factor of constipation.

A positive association between confectionery intake and constipation was observed, although we are not aware of any research reporting this association. We also found an adverse effect of Japanese and Chinese tea, which is in agreement with a study of Singapore (Wong *et al.*, 1999), and a preventive effect of coffee, generally consistent with a study of the US (Dukas *et al.*, 2003). It is unclear why these foods had such effects on constipation. Although our finding regarding these foods may have been due to chance alone given the large number of statistical analyses conducted in the present study and intake of these foods may be a marker of other lifestyle factors that were not addressed, further studies examining the association between constipation and these foods would be some of interest.

Constipation seemed to be associated with intake of energy (Sandler *et al.*, 1990; Towers *et al.*, 1994), fluids (water and pure fruit juices) (Sanjoaquin *et al.*, 2004), beverages (sweetened, carbonated, and noncarbonated) (Sandler *et al.*, 1990), tea (Sandler *et al.*, 1990), meats (Sandler *et al.*, 1990; Sanjoaquin *et al.*, 2004), eggs (Nakaji *et al.*, 2002), dairy products (Sandler *et al.*, 1990), and fish (Sandler *et al.*, 1990; Sanjoaquin *et al.*, 2004) in previous studies. We, however, did not find any association of constipation with these dietary factors in the present study. These discrepancies may be, at least partially, explained by the differences in the characteristics, dietary habits, and lifestyle of the subjects examined, dietary assessment methods used, and definitions of constipation applied among studies.

The effect of dietary fiber on constipation is widely accepted, but only a few studies have found an inverse association between dietary fiber and constipation (Dukas *et al.*, 2003; Sanjoaquin *et al.*, 2004), and many other studies have failed to find this association (Everhart *et al.*, 1989; Whitehead *et al.*, 1989; Campbell *et al.*, 1993; Towers *et al.*, 1994). Unexpectedly, there seemed to be a positive association between dietary fiber intake and constipation in the present study, although the association disappeared after further adjustment for rice intake, suggesting that the association is largely due to an inverse association between rice intake and constipation. The positive association between dietary fiber and constipation may be because subjects suffering from constipation might increase their dietary fiber intake. This is particularly prevalent in the present study because the subjects are dietetic students and therefore may be highly health conscious. However, women with current dietary counseling were excluded from the present analysis. Additionally, not only was intentional dietary change, self-reported in DHQ, not significantly associated with constipation, but also the analyses, further adjusted for intentional dietary changes or after excluding the subjects who reported intentional dietary change within one year, provided identical results (data not shown). Another explanation of the positive association between dietary fiber and constipation is that dietary fiber intake was too low to have a protective effect for constipation for most women. The amount of dietary fiber estimated in the present study (mean: 12.0 g/day), however, was comparable with that observed in women aged 18–29 years in the Japanese National Nutrition Survey in 2001 (12.8 g/day) (Ministry of Health and Welfare, 2003) and 2002 (12.0 g/day) (Ministry of Health and Welfare, 2004), which has been available since 2001.

As a result of this unexpected association between dietary fiber and constipation and the possibility that subjects suffering from constipation might increase their dietary fiber intake and hence change their diet, the findings regarding foods, particularly those significantly associated with constipation in the present study (rice, confectioneries, Japanese and Chinese tea, and coffee), should be interpreted with great caution. We cannot deny that the association between these foods and constipation merely reflects dietary behaviors changed after, not before, suffering from constipation, although the findings on these foods were independent of dietary fiber intake and these foods are generally unlikely to be recognized as those having an influence of constipation. As mentioned above, however, previous studies have shown similar findings on rice (Wong *et al.*, 1999; Nakaji *et al.*, 2002), Japanese and Chinese tea (Wong *et al.*, 1999), and coffee (Dukas *et al.*, 2003). Unfortunately, these are all cross-sectional findings; prospective research on this area is required.

Findings regarding dietary factors also need to be cautiously interpreted in terms of dietary assessment methodology. First, the DHQ measures only the memory and perception of usual diet, although we used a previously-validated questionnaire (Sasaki *et al.*, 1998a, b; 2000b). Second, selective under- and/or overestimation of dietary intake, which may affect the energy-adjusted intake in a biased way, is a serious problem in many populations (Livingstone and Black, 2003) as well as the women examined here (Okubo and Sasaki, 2004). However, a repeated analysis presented in Tables 2 and 3 after excluding 400 subjects with implausible reported energy intake (women with the ratio of reported energy intake to basal metabolic rate, estimated using the FAO/WHO/UNU equation (FAO/WHO/UNU, 1985), of <1.2 or >2.5 (Black *et al.*, 1996)) provided the similar results. We thus believe that the associations in the present study are not spurious associations created by inaccurate dietary data.

Constipation has been associated with smoking status (Dukas *et al.*, 2003), alcohol drinking (Nakaji *et al.*, 2002; Dukas *et al.*, 2003; Sanjoaquin *et al.*, 2004), and BMI (Sandler *et al.*, 1990; Dukas *et al.*, 2003; Sanjoaquin *et al.*, 2004) in previous studies, but we observed no significant association of constipation with these variables. These null associations may be due to the large proportions of women without habits of smoking (94%) or alcohol drinking (78%) and with a normal BMI (78%). Physical activity has also been associated with constipation in several studies (Everhart *et al.*, 1989; Sandler *et al.*, 1990; Dukas *et al.*, 2003; Sanjoaquin *et al.*, 2004); we, however, did not find the association. This may be because of our relatively rough assessment of physical activity because we classified the subjects only into two groups according to the frequency of participating sports club activities without consideration of other kinds of activities.

In the present study, the assessment of constipation was based strictly on self-reporting, although subjects who were considered to be 'constipated' had significantly fewer bowel movements than did other subjects. The proportion of the subjects who were considered 'constipated' in the present study seemed to be relatively high (26%); some of those may not be classified as 'constipated' according to symptom-based criteria such as Rome I and Rome II criteria (Thompson *et al.*, 1999). In fact, the prevalence of self-reported constipation was much higher compared with the prevalence based on Rome I and Rome II criteria in a study of Spain (30 vs 19 and 14%) (Garrigues *et al.*, 2004). Thus, whether the same associations we observed would hold for constipation according to symptom-based criteria is not known, which should be addressed in future studies.

Although the use of medications may be associated with constipation (Wong *et al.*, 1999; Dukas *et al.*, 2003; Talley *et al.*, 2003), this variable was not assessed in the present study. We, however, analyzed only the data of apparently healthy women without any disease at the time of study to minimize the confounding by medication usage. Additionally, our results might not be representative because the subjects were selected female dietetic students.

In conclusion, intake of rice and coffee was inversely and intake of confectioneries and Japanese and Chinese tea was positively associated with self-reported constipation in a group of young Japanese women. As a result of the cross-sectional nature of the present study, which precludes any causal inferences, several limitations, particularly possibility that subjects suffering from constipation might increase their dietary fiber intake and hence change their diet and the use of self-reported constipation, and the lack of biological explanation for the associations we observed, however, further observational (favorably, prospective) and experimental studies are required to clarify these relationships.

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DIETARY REFERENCE INTAKES FOR JAPANESE (2005)

(THE REPORT FROM THE SCIENTIFIC COMMITTEE OF "DIETARY REFERENCE INTAKES FOR JAPANESE -- RECOMMENDED DIETARY ALLOWANCE --")

OCTOBER, 2004

MINISTRY OF HEALTH, LABOUR AND WELFARE, JAPAN

NOTE

This English translation was a part* of the report.

(*General Theories, Energy, and Outline)

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I. GENERAL THEORIES

1. Characteristics of Designing Policies

Dietary Reference Intakes for Japanese, 2005 (DRIs-J) was prepared for healthy individuals or groups and designed to show reference intake values of energy and each nutrient to maintain and promote health and prevent lifestyle-related diseases. DRIs-J have been prepared not only to prevent energy or nutrient deficiency that may be caused by inadequate nutrient intake: it is also designed for the primary prevention of lifestyle-related diseases and illnesses caused by excess consumption of energy and nutrients.

The current DRIs-J have followed an approach of DRIs-J's concept which was introduced in the prior revision (the 6th revised Recommended Dietary Allowance and Dietary Reference Intake for Japanese, 1999) and the concept was thoroughly implemented in this revision. It is desired that those who use this DRIs-J should not become too preoccupied with the values presented; but should understand the concept of the DRIs-J thoroughly and apply them correctly.

The DRIs-J were prepared on a scientific basis as much as possible. Domestic and overseas academic papers and obtainable scientific data were utilized to the maximum. Furthermore, those dissertations and academic materials that were used in the revision of the prior edition were also reevaluated.

2. Basic Concept

2-1. General Concept

The traditional approach based on the concept of providing only the minimum requirements to avoid nutrient deficiencies is not sufficient to respond to the aim of prevention of lifestyle-related diseases and dysfunctions due to excess intake of nutrients. It is necessary to indicate a "range of intake" and introduce an idea that ones intake should stay within the range. It must also be shown clearly that if one were to consume any of the nutrients in excess of its range, it may lead to a risk of disease due to the excessive intake. This is the first basic concept in establishing DRIs-J.

In reality, "true" optimal intake varies among individuals and within an individual. Therefore, the 'true' optimal intake cannot be measured or estimated. This fact leads to a need of a probability approach in their computation or application. This is the second basic concept behind the DRIs-J, which uniquely characterizes this revision.

Based on these two concepts, one index for energy and five indices for nutrients are presented below. These indices are comprehensively called "Dietary Reference Intakes (DRIs-J)."

2-2. Energy

Energy must be computed based on a concept that is different from those used for nutrients. An adult requires a fixed amount of energy to maintain his/her body weight: if his/her intake does not meet the requirement, weight losses, emaciation, and protein energy malnutrition may ensue; if the intake exceeds the required intake, weight gain or obesity may occur. It is understood that the optimum state of energy intake is achieved when energy intake and consumption are balanced, causing no changes in body weight.

The double-labeled water (DLW) method is used to determine energy expenditure by healthy individual who maintain normal daily activities. The United States and Canada were the first in the world to adopt this technique in their dietary reference intakes for estimating energy expenditure. Due to the cost of the DLW (150,000 yen/person) and urine cell analyzer and the technical skill for the operation, sufficient numbers of samples are not available to compute Estimated Energy Requirement (EER) in Japan. For this reversion, the EER for an adult was computed from his/her Basal Metabolic Rate (BMR) (= reference BMR x reference body weight) and Physical Activity Level (PAL).

EER for adults (kcal/day) = BMR x PAL

Based on the data of DLW studies, the PAL was divided into 3 levels for an adult: level I (low, 1.50), level II, (normal, 1.75), and level III (high, 2.00).

For infants and children in the growth stage, the EER includes that needed to maintain the current body weight plus that which is necessary for growth. For pregnant women and nursing mothers, additional energy values due to fetal growth and lactating were added to complete the EER.

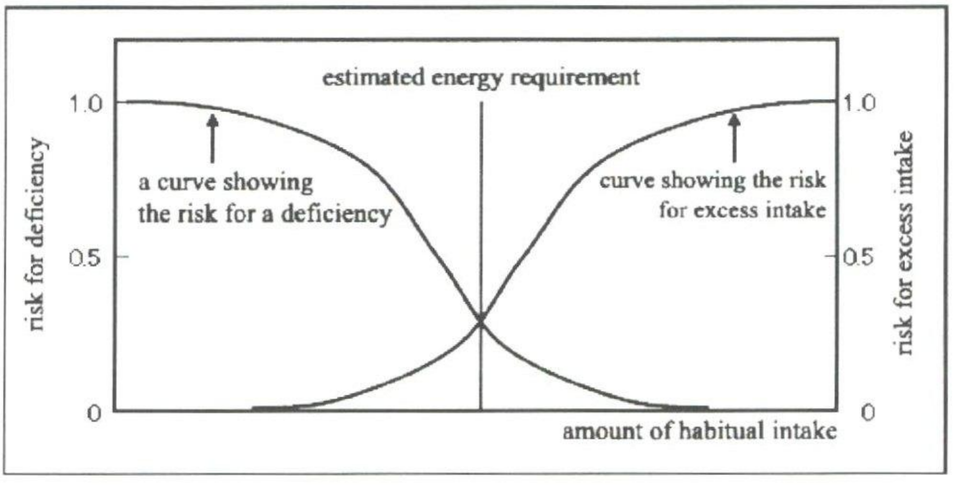

Fig. 1 A model to aid in the comprehension of Estimated Energy Requirement (EER)
With an increase in habitual intake, the risk for insufficiency is reduced and that for excessive intake increases. The intake at which both of these risks are the lowest is EER.

2-3 Nutrients

2-3-1. Indices

For the nutrients, Estimated Average Requirements (EAR) and Recommended Dietary Allowance (RDA) were selected as indices for the presence (or absence) of a deficiency and its extent.

Adequate Intake (AI) was computed for nutrients that were unable to determine EAR and RDA. For certain nutrients, DRIs-J have been defined for the primary prevention of lifestyle-related diseases. For these, "the quantity that the modern Japanese must consume for the primary prevention of lifestyle-related diseases" is indicated: it is called Tentative Dietary Goal for Preventing Life-style Related Diseases (DG).

Upper Intake Level (UL) was set to prevent diseases that would be caused by an excessive intake of certain nutrients. However, there are nutrients refrained from setting UL due to a lack of sufficient scientific data. Fig. 2 represents the general concept of these indices.

Table 1 shows those nutrients for which DRIs-J have been set and the indices that have been provided for ages one year and over. Thirty-four nutrients were investigated. For infants (ages 0 through 11 months), the adequate intake was set for twenty-eight nutrients, excluding saturated fatty acids, cholesterol, carbohydrates, dietary fibers and chromium.

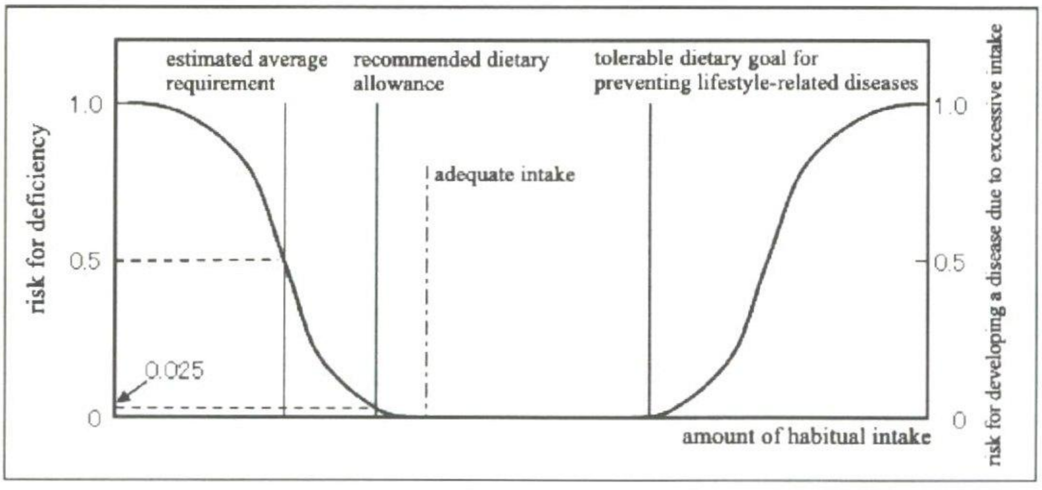

Fig. 2 A model to aid in understanding the indices for DRIs-J (Estimated Average Requirement, Recommended Daily Allowance, Adequate Intake and Tolerable Upper Intake Level)

The figure shows the risk of deficiency exist for 0.5 (50%) for EAR and 0.02 to 0.03 (mean, 0.025, 2 to 3% or 2.5%) for RDA. Note that there is a potential risk of developing a disease from adverse effects due to excessive intake when the amount exceeds UL. It can also be seen that when the intake is between RDA and UL, the risk of a deficiency or developing a disease due to excessive intake is near zero (0).

An AI is not in a fixed relationship with EAR or RDA. If it is possible to compute the last two simultaneously, the estimated intake is believed to be greater than RDA (on the right side in the figure). The estimated intake was added for reference.

Because the DG is determined from the EDA or AI and the median of the current intake, it cannot be displayed here.

Table 1 Nutrients for which DRIs-J have been established and its indices (ages 1 year and over)[1]

		EAR	RDA	AI	DG	UL
Proteins		○	○	-	○	-
Lipids	Total fats	-	-	-	○	-
	Saturated fatty acids	-	-	-	○	-
	n-6 fatty acids	-	-	○	○	-
	n-3 fatty acids	-	-	○	○	-
	Cholesterol	-	-	-	○	-
Carbohydrates		-	-	-	○	-
Dietary fibers		-	-	○	○	-
Water-soluble vitamins	Vitamin B_1	○	○	-	-	-
	Vitamin B_2	○	○	-	-	-
	Niacin	○	○	-	-	○
	Vitamin B_6	○	○	-	-	○
	Folic acid	○	○	-	-	○[2]
	Vitamin B_{12}	○	○	-	-	-
	Biotin	-	-	○	-	-
	Pantothenic acid	-	-	○	-	-
	Vitamin C	○	○	-	-	-
Oil-soluble vitamins	Vitamin A	○	○	-	-	○
	Vitamin E	-	-	○	-	○
	Vitamin D	-	-	○	-	○
	Vitamin K	-	-	○	-	-
Minerals	Magnesium	○	○	-	-	○[2]
	Calcium	-	-	○	○	○
	Phosphorus	-	-	○	-	○
Trace elements	Chromium	○	○	-	-	-
	Molybdenum	○	○	-	-	○
	Manganese	-	-	○	-	○
	Iron	○	○	-	-	○
	Copper	○	○	-	-	○
	Zinc	○	○	-	-	○
	Selenium	○	○	-	-	○
	Iodine	○	○	-	-	○
Electrolytes	Sodium	○	-	-	○	-
	Potassium	-	-	○	○	-

DRIs-J, Dietary Reference Intakes for Japanese; EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; DG, tentative dietary goal for preventing life-style related diseases; UL, tolerable upper intake level

[1] Including when the DRIs-J were defined for only certain age groups.

[2] Defined as intake from other than normal food.

2-3-2. Estimated Average Requirement (EAR)

Estimated Average Requirement (EAR) is defined as estimated mean value of requirement of a general population (e.g., men ages 30 through 49 years) computed based on date of distribution of the "requirement" determined in a certain group. In other words, it is defined as estimated requirement which would fulfill 50 percent of the group.

2-3-3. Recommended Dietary Allowance (RDA)

Recommended Dietary Allowance (RDA) is defined as the amount that would fulfill almost all (97 to 98 percent) of the individuals in the general population which is computed based on the distribution of the "requirement" determined in subject groups.

By using the standard deviation (SD) of person-to-person variation in the experimentally derived requirements as the estimated standard deviation of inter-individual differences of the requirement in the general group, the RDA can be theoretically computed as the "mean of estimated requirement + 2 x SD of estimated requirement." In actual practice, however, an accurate standard deviation for the estimated requirement is rarely obtained from experimental data. In many instances, one has to rely on the estimated value. The standard deviations used in computing the recommended dietary allowance in the current updated version are listed as coefficients of variation (CV: standard deviation/average value) in Table 2.

RDA = EAR x coefficient for RDA