Pearson correlation coefficients between the DHQ and 3-day estimated dietary records were 0.48 for energy, 0.48 to 0.55 for energy-yielding nutrients, and 0.19 to 0.68 for vitamins and minerals (17). Mean difference between the DHQ and 3-day estimated dietary records (3-day estimated dietary records were used as a reference) among the 47 women was 1% for energy, −10% to 3% for energy-yielding nutrients, and −25% to 16% for vitamins and minerals (17). In addition, the Pearson correlation coefficients between the DHQ and 16-day weighed dietary records among 92 women were 0.28 for energy, 0.35 to 0.79 for energy-yielding nutrients, 0.69 for dietary fiber, and 0.29 to 0.63 for vitamins and minerals, and the Spearman correlation coefficients were 0.55 for soft drinks and 0.28 to 0.59 for other food groups (Sasaki S, unpublished observations, 2007). Mean difference between the DHQ and 16-day weighed dietary records (16-day weighted dietary records were used as a reference) among 92 women was 3% for energy, −11% to 1% for energy-yielding nutrients, −6% for dietary fiber, −12% to 16% for vitamins and minerals, 11% for soft drinks, and −52% to 82% for other food groups (Sasaki S, unpublished observations, 2007).

Other Variables

Body weight and height were self-reported as part of the DHQ. Body mass index was calculated as weight (in kilograms) divided by the square of height (in meters). Residential areas, reported in the 12-page lifestyle questionnaire, were grouped into six regions (Hokkaido and Tohoku, Kanto, Hokuriku and Tokai, Kinki, Chugoku and Shikoku, and Kyushu) based on blocks used in the National Nutrition Survey of Japan (14), and hereafter referred to as the residential block. The residential areas were also grouped into three categories according to population size (cities with a population more than 1 million, cities with a population less than 1 million, and towns and villages), and hereafter referred to as size of residential area. The lifestyle questionnaire also assessed living status (living alone, living with family, or others), current smoking (yes or no), and whether currently trying to lose weight (yes or no). In addition, subjects reported in the questionnaire the time they usually got up and went to bed, which was used to calculate sleeping hours, and the frequency and duration of high- and moderate-intensity activities, walking, and sedentary activities. Physical activity level was calculated by dividing total energy expenditure, calculated based on metabolic equivalent-hour score (21), by basal metabolic rate calculated using a published equation for Japanese women aged 18 to 29 years (22). The calculation method has been described in detail elsewhere (23).

STATISTICAL ANALYSES

All statistical analyses were performed using SAS statistical software (version 8.2, 2001, SAS Institute Inc, Cary, NC). Multivariate-adjusted means of food, beverage, energy, and nutrient intake were calculated by quintiles of soft drink intake. Food, beverage, and nutrient intake was adjusted for total energy intake using the multivariate nutrient density model (24) This model computes nutrient density (calculated by dividing nutrient values by total energy intake: percentage of energy for energy-yielding nutrients and the amount per 1,000 kcal for foods, beverages, and other nutrients) and then entered together with total energy intake as a covariate into a multiple regression model. Confounding variables included in the multivariate nutrient density models for energy intake were residential block, size of residential area, living status, current smoking, current alcohol drinking, current dietary supplement use, currently trying to lose weight, rate of eating, and physical activity level (continuous). Linear trends with quintiles of soft drink intake were tested by assigning to each participant the median value for the category and modeling this value as a continuous variable. All reported P values are two-tailed and were considered statistically significant at the <0.05 level.

Table 1. Comparison of mean daily intake of energy and nutrients between female Japanese dietetics students aged 18 to 20 years (n=3,931)[a] and women in the United States aged 12 to 19 years (n=1,103)[b]

Nutrient	Japanese students		American students	
	←—— *mean±standard error*		——→	
Energy (kcal/d)	1,822	8.0	1,993	45.7
Protein (% energy)	13.3	0.03	13.4	0.25
Fat (% energy)	30.0	0.09	32.1	0.61
Saturated fatty acids (% energy)	8.0	0.03	11.0	0.24
Carbohydrate (% energy)	55.2	0.11	55.5	0.60
Cholesterol (mg/d)	304.2	2.4	203.0	9.1
Sodium (mg/d)	3,821	23.5	3,041	90.1
Potassium (mg/d)	2,021	13.5	2,162	58.2
Calcium (mg/d)	506.1	3.8	793.0	26.5
Magnesium (mg/d)	217.1	1.3	216.0	5.7
Iron (mg/d)	6.81	0.04	13.4	0.44
Vitamin A (μg/d)	484.7	5.6	768.0	49.6
Vitamin E (mg/d)	9.96	0.07	7.6	0.3
Thiamin (mg/d)	0.755	0.004	1.4	0.04
Riboflavin (mg/d)	1.26	0.01	1.7	0.05
Vitamin C (mg/d)	86.0	0.7	95.0	5.6

[a]Energy and nutrient intake was estimated from diet history questionnaire used for this study in 2005.
[b]Data are from the National Health and Nutrition Examination Survey 1999-2000 (24). Energy and nutrient intake was estimated from a 24-hour recall interview.

RESULTS

The mean age of subjects was 18.1±0.3 years. Mean body mass index was 21.0±2.8. Mean soft drink intake was 70.6±93.0 g/1,000 kcal.

Table 1 presents the comparison of daily mean intake of energy and selected nutrients between Japanese women in our study and representative female Americans aged 12 to 19 years (25). The Japanese women in our study had higher intake of cholesterol, sodium, and vitamin E and lower intake of fat, saturated fat, calcium, iron, vitamin A, thiamin, riboflavin, and vitamin C.

Table 2. Subject characteristics according to quintile (Q) of soft drink intake among female Japanese dietetics students aged 18 to 20 years (n=3,931)[a]

	Q1 (n=786)	Q2 (n=786)	Q3 (n=787)	Q4 (n=786)	Q5 (n=786)	
Soft drink intake range (g/1,000 kcal)	**0-4.4**	**4.5-27.9**	**28.0-59.9**	**60.0-112.0**	**113.0-1,328.5**	***P* value for trend[b]**
	←		*mean±standard deviation*		→	
Soft drink intake (g/1,000 kcal)	0.7±1.3	15.5±6.8	43.3±9.1	83.4±15.1	209.9±121.1	<0.0001
	←		*frequency of subjects (%)*		→	
Size of residential area						0.002
City with population ≥1 million	24	20	18	19	18	
City with population <1 million	64	64	66	65	65	
Town and village	12	16	16	16	17	
Living status						0.0004
Living with family	84	89	90	90	90	
Living alone	13	9	8	8	8	
Others	3	1	2	2	2	
Current smoker	2	1	1	1	3	0.009
Subjects currently trying to lose weight	39	36	37	36	33	0.04

[a]Variables, including age, body height, body weight, body mass index, physical activity level, area of residence, current alcohol drinking status, current supplement use, and rate of eating were not significantly different among subjects according quintiles.

[b]For continuous variables, tests for linear trend used the median value in each quintile as a continuous variable in linear regression; the Mantel-Haenszel χ^2s test was used for categorical variables.

Table 2 shows subject characteristics according to quintile of soft drink intake. Subjects in higher quintiles of intake were more likely to live in cities with a population less than 1 million or in a town or village, live with their family and smoke and were less likely to live in city with a population more than 1 million, live alone, and be currently trying to lose weight. No difference was observed for age, body height, body weight, body mass index, physical activity level, residential block, current alcohol drinking status, current supplement use, and rate of eating among subjects in quintiles (data not shown).

Multivariate-adjusted mean dietary intake according to quintile of soft drink intake is presented in Table 3. For foods, intake of soft drinks was associated positively with intake of confections, fat and oil, and noodles (all $P \le 0.0005$ for trend) and negatively with intake of vegetables, fruits, pulses, fish and shellfish, rice, eggs, and potatoes (all $P \le 0.03$ for trend). For beverages, intake of soft drinks was positively associated with 100% vegetable and fruit juices and diet soft drinks (both $P \le 0.0001$ for trend), and negatively with intake of milk, coffee and black tea, and traditional Japanese tea (all $P \le 0.002$ for trend). For energy and nutrients, intake of soft drinks was associated positively with intake of energy and carbohydrates (both $P<0.0001$ for trend) and negatively with intake of protein, dietary fiber, cholesterol, and all of the micronutrients examined (all $P<0.0001$ for trend) except for vitamin C ($P=0.09$ for trend). In contrast, intake of soft drinks was not associated significantly with intake of foods, including meat, bread, and milk products or nutrients including fat, saturated fatty acids, and vitamin C (data not shown).

DISCUSSION

Among young Japanese women, a higher intake of soft drinks was associated with higher intake of confections, fat and oil, noodles, 100% vegetable and fruit juices, diet soft drinks, energy, and carbohydrates and lower intake of vegetables, fruits, pulses, fish and shellfish, rice, eggs, potatoes, milk, coffee and black tea, traditional Japanese tea, protein, dietary fiber, cholesterol, and most of the micronutrients examined. The observation was consistent with the hypothesis with few exceptions. Moreover, although mean intake of soft drinks among Japanese population in our study was much lower (144 g/day) than that of US youth aged 12 to 19 years (683 g/day) (26), significantly lower intake of foods such as vegetables, fruits, and pulses and key nutrients was found as intake of soft drinks increased. These findings suggest that the soft drink intake may be associated with poor diet quality even if the amount of intake is small.

Several studies in the United States have investigated the relationship between soft drink and nutrient intake among similar age groups (7,9-12). Harnack and colleagues (9) reported that a higher intake of soft drinks was associated with higher intake of energy and carbohydrate and lower intake of protein, calcium, vitamin A, vitamin C, and riboflavin among 423 young people aged 13 to 18 years. Bowman (7) studied 732 young people aged 12 to 19 years and observed higher intake of energy, total fat, saturated fat, protein, and added sugars among non–milk drinkers who drank soda compared with non-milk drinkers who did not drink soda. They also observed a higher intake of added sugars and lower intake of calcium, magnesium, vitamin A, and riboflavin among milk drinkers who also drank soda compared with milk-drinkers who did not drink soda. Guenther (10) found a positive correlation between soft drink intake and intake of energy, fat, and carbohydrate and a negative correlation with intake of calcium, magnesium, vitamin A, riboflavin, and vitamin C among 4,455 youth aged 13 to 18 years. Ballew and colleagues (11) found a negative asso-

Table 3. Food, beverage, energy, and nutrient intake according to quintile (Q) of soft drink intake among female Japanese dietetics students aged 18 to 20 years (n=3,931)[a]

Soft drink intake range (g/1,000 kcal)	Q1 (n=786) 0-4.4	Q2 (n=786) 4.5-27.9	Q3 (n=787) 28.0-59.9	Q4 (n=786) 60.0-112.0	Q5 (n=786) 113.0-1,328.5	*P* value for trend[b]
	←		*mean± standard deviation*		→	
Food group (g/1,000 kcal)[c]						
Confections	37.7±0.6	37.9±0.6	39.1±0.6	40.6±0.6	41.8±0.6	<0.0001
Fat and oil	12.7±0.2	13.2±0.2	13.5±0.2	14.0±0.2	14.1±0.2	<0.0001
Vegetables	150.3±2.9	133.3±2.8	121.7±2.8	116.2±2.8	114.0±2.9	<0.0001
Fruits	32.4±1.0	28.7±1.0	27.8±1.0	27.3±1.0	28.0±1.0	0.03
Pulses	30.1±0.6	26.6±0.6	24.4±0.6	22.1±0.6	21.3±0.6	<0.0001
Fish and shellfish	32.1±0.6	30.8±0.6	31.3±0.6	28.8±0.6	27.2±0.6	<0.0001
Rice	167.9±2.3	169.4±2.3	161.5±2.3	152.2±2.3	143.3±2.3	<0.0001
Noodles	31.7±1.2	36.3±1.1	37.7±1.1	39.2±1.1	38.5±1.2	0.0005
Eggs	19.8±0.5	19.1±0.5	18.4±0.5	17.5±0.5	15.8±0.5	<0.0001
Potatoes	17.1±0.4	15.8±0.4	15.6±0.4	16.0±0.4	14.9±0.4	0.002
Beverage group (g/1,000 kcal)[c]						
Milk	54.0±2.3	49.2±2.3	46.4±2.3	48.1±2.3	42.9±2.3	0.002
Coffee and black tea	39.8±2.2	25.3±2.2	15.8±2.2	10.0±2.2	4.7±2.2	<0.0001
100% vegetable and fruit juices	27.1±2.0	24.9±1.9	27.5±1.9	29.3±1.9	35.3±1.9	0.0001
Diet soft drinks	3.7±0.9	3.1±0.9	3.5±0.9	5.5±0.9	8.7±0.9	<0.0001
Traditional Japanese tea	341.8±8.9	312.9±8.8	292.2±8.8	282.6±8.8	254.3±8.9	<0.0001
Energy and nutrients						
Energy (kcal/day)	1,690±18	1,805±17	1,818±17	1,876±17	1,920±18	<0.0001
Nutrients[c]						
Protein (% energy)	13.9±0.1	13.5±0.1	13.4±0.1	13.0±0.1	12.5±0.1	<0.0001
Carbohydrate (% energy)	54.9±0.2	55.0±0.2	54.8±0.2	55.1±0.2	56.4±0.2	<0.0001
Dietary fiber (g/1,000 kcal)	7.1±0.1	6.5±0.1	6.3±0.1	6.2±0.1	6.1±0.1	<0.0001
Cholesterol (mg/1,000 kcal)	172.4±2.2	169.0±2.2	168.0±2.2	162.2±2.2	152.6±2.2	<0.0001
Sodium (mg/1,000 kcal)	2,153±20	2,118±19	2,113±19	2,068±19	2,026±19	<0.0001
Potassium (mg/1,000 kcal)	1,183±10	1,103±10	1,072±10	1,063±10	1,075±10	<0.0001
Calcium (mg/1,000 kcal)	301±4	279±4	271±4	268±4	259±4	<0.0001
Magnesium (mg/1,000 kcal)	127±1	119±1	116±1	116±1	116±1	<0.0001
Iron (mg/1,000 kcal)	3.99±0.03	3.77±0.03	3.68±0.03	3.61±0.03	3.54±0.03	<0.0001
Vitamin A (μg/1,000 kcal)	297±6	277±6	259±6	241±6	234±6	<0.0001
Vitamin D (mg/1,000 kcal)	3.9±0.1	3.7±0.1	3.7±0.1	3.4±0.1	3.2±0.1	<0.0001
Vitamin E (mg/1,000 kcal)	5.6±1.0	5.4±1.0	5.3±1.0	5.3±1.0	5.2±1.0	<0.0001
Thiamin (mg/1,000 kcal)	0.430±0.003	0.413±0.003	0.408±0.003	0.403±0.003	0.396±0.003	<0.0001
Riboflavin (mg/1,000 kcal)	0.74±0.01	0.70±0.01	0.69±0.01	0.67±0.01	0.65±0.01	<0.0001

[a]Intake of soft drinks was not associated significantly with intake of meat, bread, and milk products; and fat, saturated fatty acids, and vitamin C.

[b]Tests for linear trend used the median value in each quintile as a continuous variable in linear regression. Confounding variables included in the multivariate models for energy intake were residential block (Hokkaido and Tohoku, Kanto, Hokuriku and Tokai, Kinki, Chugoku and Shikoku, and Kyushu), size of residential area (city with ≥1 million, city with <1 million, and town and village), living status (living with family, living alone, or others), current smoking (yes or no), current alcohol drinking (yes or no), current dietary supplement use (yes or no), currently trying to lose weight (yes or no); rate of eating (very slow, relatively slow, medium, relatively fast, or very fast), and physical activity level (continuous). For food, beverage, and nutrient intake, energy intake (kcal/day, continuous) was further adjusted.

[c]Food, beverage, and nutrient intake was energy-adjusted using the density method (percentage of energy for energy-yielding nutrients and the amount per 1,000 kcal for foods, beverages, and other nutrients).

ciation between intake of carbonated soda and magnesium and vitamin A in 988 youths aged 12 to 17 years, whereas Frary and colleagues (12) observed that a higher intake of sugar-sweetened beverages was associated with a higher intake of saturated fatty acids and lower intake of calcium and fiber in 1,125 young people aged 12 to 17 years. This latter group also found that a higher intake of sugar-sweetened beverages was associated with a higher intake of added sugars and a lower intake of fruits and milk and milk products. These findings in US populations are consistent with the present results from young Japanese women, which showed a positive association between intake of soft drinks and intake of confections and fat and oil and energy and a negative association between intake of soft drinks and intake of fruits and key nutrients such as protein, dietary fiber, calcium, magnesium, vitamin A, and riboflavin. Because soft drinks provide little nutritional value besides energy (27) and because the dietary intake during youth is critical for subsequent health in adulthood (28), these findings are of further concern.

Furthermore, the comparison of energy and nutrient intake between Japanese women in our study and the representative female Americans aged 12 to 19 years (24) showed the different characteristics of dietary intake between these two populations. Intake of Japanese women in our study had higher intake of cholesterol, sodium, and vitamin E and lower intake of fat, saturated fat, calcium, iron, vitamin A, thiamin, riboflavin, and vitamin C. Higher intake of sodium may be due to use of salt, soy sauce, and miso, which are the most common condiments traditionally used in the Japanese diet (16), whereas higher intake of cholesterol may owe to habitual intake of fish and shellfish (eg, squid and cuttlefish, salmon, spiny lobster, and tuna) and eggs, which are the major contributors of cholesterol to the Japanese diet (29). Regardless of the different populations investigated and different characteristics of nutrient intake, the results of our study suggest that soft drink intake may be associated with poor diet quality.

Regarding soft drink consumption among youth in the United States, much attention has been focused on calcium inadequacy (7,9-12). Calcium is found in a variety of foods, including dairy products (eg, milk, cheese, and yogurt), green leafy vegetables, tofu and other soy-based products, and seaweed (eg, kombu, hijiki, and wakame). In our study of young Japanese women, the results showed that intake of soft drinks was negatively associated with the intake of calcium, vegetables, pulses, and milk, but not milk products (Table 3). In fact, soft drink intake was negatively associated with most of the micronutrients examined, which raises concern for diet quality.

Several limitations with the interpretation of the results can be identified. First, the cross-sectional design of this study cannot establish cause and effect relationship between soft drink intake and diet quality. For example, although the results from this study show that soft drink intake is positively associated with intake of fat and oil, soft drinks may not necessarily cause the consumption of fat and oil. Second, the study sample was selected female students in dietetics courses. The subjects may have had relatively more healthful lifestyles, and thus the generalizability of this study is limited. Third, dietary assessment was conducted by using a self-administered DHQ, and measurement error is likely. In addition, data from 24-hour recall in the United States and the DHQ used in this study may not be directly comparable. However, the DHQ was shown to properly rank individuals and obtain absolute intake in comparison to dietary records (17, Sasaki S, unpublished observations, 2007). Fourth, residual confounding may still be present although adjustment for major confounding variables was conducted.

CONCLUSIONS

Intake of soft drinks was positively associated with intake of confections, fat and oil, noodles, 100% vegetable and fruit juices, diet soft drinks, energy, and carbohydrates and negatively with intake of vegetables, fruits, pulses, fish and shellfish, rice, eggs, potatoes, milk, coffee and black tea, traditional Japanese tea, protein, dietary fiber, cholesterol, and most of the micronutrients examined in a group of Japanese women aged 18 to 20 years. Because the intake of soft drinks in our study subjects was much lower than that in the United States, our results suggest that the soft drink intake may be associated with poor diet quality even if the amount of intake is small. Knowing evidence on association between soft drink intake and dietary intake among Western populations as well as non-Western populations with various ranges of soft drink intake may help food and nutrition professionals in evaluating diet quality of their target subjects.

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Original Article

Dietary Reference Intakes (DRIs) in Japan

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Following the comprehensive systematic review of domestic and overseas scientific evidence, the "Dietary Reference Intakes for Japanese, 2005 (DRI-J)" was published in April, 2005. The DRIs-J were prepared for health individuals and groups and designed to present a reference for intake values of energy and 34 nutrients to maintain and promote health and to prevent lifestyle-related diseases and illness due to excessive consumption of either energy or nutrients. The DRI-J also includes a special chapter for basic knowledge of DRIs. The energy recommendation is provided as an estimated energy requirement (EER), while five indices were used for nutrients: Estimated average requirement (EAR), recommended dietary allowance (RDA), adequate intake (AI), tolerable upper intake level (UL), and tentative dietary goal for preventing lifestyle-related [chronic non-communicable] diseases (DG). Whilst the first four indices are same as the ones used in other countries, DG is unique index in Japan, which was set as a reference value for preventing non-communicable diseases such as cardiovascular (including hypertension), major types of cancer and osteoporosis. This report (DRI-J) is the first dietary guidance in Japan, which applied evidence-based approach utilizing a systematic review process. Only a few articles from within Japan and other Asian countries could be used for its establishment. The project to establish the DRI-J revealed a severe lack of researchers and publications focused upon establishing DRIs for Japanese. Further review is therefore required in preparation for the next revision scheduled in 2010.

Key Words: Dietary Reference Intakes, Recommended Dietary Allowance, Estimated Energy Requirement, Japan

HISTORY OF DIETARY RECOMMENDATIONS IN JAPAN

In Japan, the Recommended Dietary Allowances (RDA) were first established in 1970, after which a revision was made every five years. The concept of Dietary Reference Intakes (DRIs) was first introduced in the 6th revision of RDA (2000-2004).[1]

In order to follow the approach of DRIs introduced in the 6th revision more comprehensively, the 7th revision was established as the "Dietary Reference Intakes for Japanese 2005".[2]

The "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. The DRIs-J have been prepared not only to prevent energy or nutrient deficiency that may be caused by inadequate nutrient intake, but also for the primary prevention of lifestyle-related diseases and illnesses caused by excess consumption of energy and nutrients. It is expected that those who use this DRIs-J should not become too focused upon the values presented, but rather should understand the concept of the DRIs-J thoroughly and apply them correctly.

PROCESS OF ESTABLISHMENT

The project to establish DRIs-J started in April, 2002. About 100 scientists from all regions of Japan. Two-three scientists were asked to participate in this project for each nutrient. Using a systematic review process, over 15,000 publications were searched and collected during the two years. Following the review of the manuscript by the Japanese Ministry of Health, Labour, and Welfare, the "Dietary Reference Intakes for Japanese (2005)" was published in April, 2005. The current version is effective up to March 2010.

Since the DRIs were based on the results of as many reliable studies as possible, the results were integrated in accordance with the approach that is introduced in Table 1.

BASIC CONCEPTS OF DRIS-J

Basic concepts

DRIs were established based on a scientific basis, utilizing domestic and foreign research investigations and data that are available.

DRIs were based on the following three basic concepts:

1. "True" optimal intake varies among individuals and within an individual. Therefore, due to the difficulty of measuring the 'true' optimal intake for maintaining and promoting health and preventing deficiencies, a probability approach is necessary in deriving and applying optimal intake values.

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Table 1. Method to integrate the research results

Quality of the study	The presence (or absence) of studies on the Japanese	Basic concept in integration
When it is relatively even	When there are studies on Japanese as the research subjects	Priority placed on the results of studies conducted on Japanese
	When there are no studies on Japanese as the research subjects	Use of the overall means
When the quality is highly variable in each study	When there are high-quality studies on Japanese as the study subjects	Priority placed on the results of studies on Japanese
	When there are studies on Japanese as the study subjects but these studies are relatively low in quality in comparison with other studies	Select high-quality studies and use the mean of such studies
	When there are no studies on Japanese as the test subjects	

Table 2. Definitions of indices used in the DRIs-J

Indices	Definition
For energy	
Estimated Energy Requirement (EER)	The intake value at which the risks of both deficiency and excess intake are minimized
For nutrients	
Estimated Average Requirement(EAR)	The mean requirement value for Japanese (stratified by gender and age) was estimated based on requirement values determined from specific population group studies. It is the estimated daily intake level which would meet the requirement of 50 percent population of a particular gender and age group.
Recommended Dietary Allowance (RDA)	RDA is defined as the estimated daily intake level that is considered to meet the requirement of most (97 to 98%) of a particular gender and age group. RDA = mean EAR + 2 × standard deviation (of EAR)
Adequate Intake (AI)	When the sufficient scientific basis to compute EAR and RDA cannot be obtained, this the AI is a quantity that is sufficient to maintain a satisfactory nutritional status of a particular gender and age group. In general, the AI is decided determined based on epidemiological studies worked onestimating nutritional intake of healthy individuals.
Tentative Dietary Goal for Preventing Lifestyle-related Diseases (DG)	DG is defined as the intake level (or range) that Japanese should currently aim to consume primarily to prevent lifestyle-related diseases. In the DRIs, particular emphasis was placed on the primary prevention of cardiovascular diseases (e.g., hypertension, hyperlipidemia, stroke, and myocardial infarction), cancer (in particular, stomach cancer), fractures, and osteoporosis. Specifically, it was directed toward the intake of proteins, lipids (fatty acids), cholesterol, carbohydrates, dietary fiber, calcium, sodium (table salt), and potassium.
Tolerable Upper Intake Level (UL)	The maximum intake level that shows theinicates an upper limit of the habitual intake that is considered to be free of the risk of causing a disease due to excessive intake. If the intake exceeds this level, it is believed that a latent risk for developing a disease increases.

2. Emphasis should be placed on prevention of lifestyle-related diseases. To meet this, it is necessary to indicate a "range of intake" and adopt an idea that keeping one's intake in the range could reduce the risk of life-style-related diseases.
3. Clearly indicate that excessive intake beyond the range increases the risk of developing health problems due to excessive intake.

Based on these concepts, one index for energy and five indices for nutrients are presented below. These indices are collectively called "Dietary Reference Intakes (DRIs)" (Table 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 expenditure are balanced, causing no changes in body weight (for adults). Figure 1 illustrates that, with an increase in habitual intake, the risk of deficiency is reduced and that of excess intake increases. The intake at which both risks are lowest is Estimated Energy Requirement (EER).

The double-labeled water (DLW) is a method 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 DRIs for estimating energy expenditure. Due to the financial and technical constraints, the EER for an

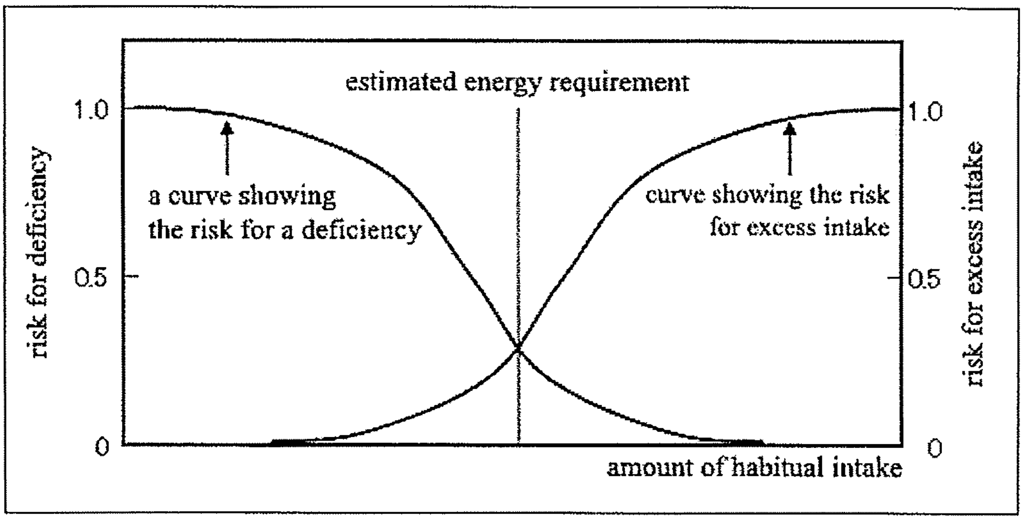

Figure 1. A model to understand the Estimated Energy Requirement (EER)

adult was calculated from his/her Basal Metabolic Rate (BMR) (= reference Basal Metabolic Rate × reference body weight) and Physical Activity Level (PAL).

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

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 lactating mothers, additional energy values due to fetal growth and lactating were added to complete the EER.

Nutrients

For 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.

The Adequate Intake (AI) was computed for nutrients for which insufficient data were available to determine EAR and RDA. For certain nutrients, the DRIs-J were determined for the primary prevention of lifestyle-related diseases. For whichhese nutrients a "Tentative Dietary Goal for Preventing Life-style Related Diseases (DG)" was set as the index to show the quantity of intake that the modern Japanese should aim to consume for the primary prevention of lifestyle-related diseases. Whilst other indices are same as the ones used in other countries, DG is an unique index in Japan. The relationship between the type of DG vis-à-vis the content and nutrients is shown in Table 3.

The Upper Intake Level (UL) was set to prevent adverse health conditions that would be caused by an excessive intake of certain nutrients. However, there are nutrients for which an UL could not be established due to a lack of sufficient scientific data. Figure 2 represents the general concept of these indices.

Table 4 shows those nutrients for which DRIs 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.

Table 3. Type of DG relative to the contents and its relations to the nutrients

Types of DG relative to the contents	Nutrients
Nutrients defined to bring their intake close to DG	Dietary fiber, n-3 fatty acids, calcium, potassium (with the intake increase desired) Cholesterol, sodium (with reductions in intake increase desired)
DG is defined within a range and nutrients intake is designed to be within this defined range	Total fats, saturated fatty acids, carbohydrates
EAR, RDA, or AI are given but only UL is listed for DG	Proteins, n-6 fatty acids

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

BASIC POINTS TO BE NOTED IN DESIGNING THE DRIS-J

Age groups

The age groups employed in the current design are; Age 0 to 5 months, 6 to 11 months, 1 to 2 years, 3 to 5 years, 6 to 7 years, 8 to 9 years, 10 to 11 years, 12 to 14 years, 15 to 17 years, 18 to 29 years, 30 to 49 years, 50 to 69 years, 70 years and older, pregnant women, and lactating mothers. Infants were divided into 2 groups: "after birth to under 6 months (ages 0 through 5 months)" and "6 months to under one year (ages 6 through 11 months)."

Children were defined as those ages 1 through 17 years and adults, those ages 18 years and over. If there is a need for separating the aged from adults, those ages 70 years and over were designated as such.

Reference physiques

For the DRIs-J, only a single representative value is obtained through computation for each gender and age group, without giving any consideration to physical distinctions (heights and weights) within each group. In other words, the DRIs-J are designed for those in the group with the representative physique. The representative physiques for those ages one year and over were based on the median heights and weights of the

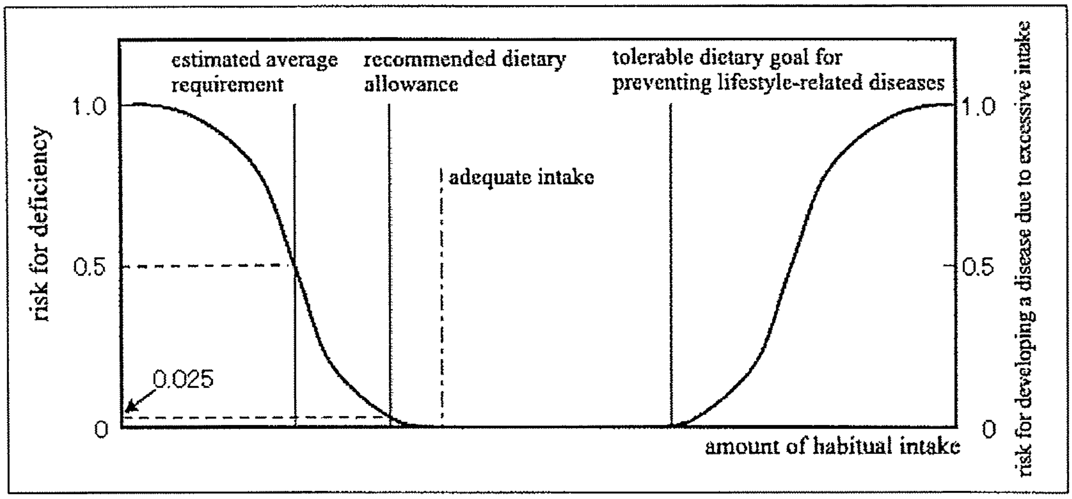

Figure 2. A model to understand the indices for DRIs (Estimated Average Requirement, Recommended Daily Allowance, Adequate Intake and Tolerable Upper Intake Level). The figure shows the risk of deficiency exist for 0.5 (50%) for EAR and 0.02 to 0.03 (mean, 0.025, 2 to 3% or 2.5%) for RDA. Note that there 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 4. Nutrients for which DRIs have been established and its indices (aged ≥ 1 year)[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	-	-	○	○	-

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 were defined for only certain age groups. [2] Defined as intake from other than normal food.

Table 5. Reference physique (reference height and reference weights)

Sex	Males		Females[1]	
Age	Reference height (cm)	Reference weights (kg)	Reference height (cm)	Reference weights (kg)
0-5 months	62.2	6.6	61.0	6.1
6-11	71.5	8.8	69.9	8.2
1-2 years	85.0	11.9	84.7	11.0
3-5	103.5	16.7	102.5	16.0
6-7	119.6	23.0	118.0	21.6
8-9	130.7	28.0	130.0	27.2
10-11	141.2	35.5	144.0	35.7
12-14	160.0	50.0	154.8	45.6
15-17	170.0	58.3	157.2	50.0
18-29	171.0	63.5	157.7	50.0
30-49	170.0	68.0	156.8	52.7
50-69	164.7	64.0	152.0	53.2
≥70	160.0	57.2	146.7	49.7

[1] Excluding pregnant women.

corresponding gender and age that were obtained at the time of the 2001 National Nutrition Survey in Japan [3] and for infants ages 0 through 11 months, the median of the group of corresponding age (in months) obtained from the 2000 National Growth Survey in Infancy and Childhood [4] were used. These are called the "reference physiques" (reference heights and reference weights) (**Table 5**).

Notes for each life stage

Infant. Experiments cannot be conducted on infants less then 6 months old to determine their EAR or RDA. It was assumed that the quality and quantity of human milk consumed by healthy infants would be equivalent to the optimum nutritional requirement for infants. For the infants' DRIs, AI was computed: specifically, the product of the nutrient concentration of the human milk and the amount consumed by the infant was used. The mean quantity taken by an infant during this period has been reported to be 0.78 L/day.[4)] Therefore the standard quantity consumed by a healthy infant was set at 0.78 L/day for the DRIs.

For infants ages 6 through 11 months, consumption of food other than human milk (or other milk products prepared for infants) must be taken into consideration; however, valid, accurate data are scarce. The values for infants aged 0 through 5 months and/or those 1 through 2 years were extrapolated.

Children. Very few studies are available that would be sufficient to set DRIs for children. When sufficient data were not extant, the values were estimated by employing the extrapolation method to those values of adults.

Because of the scarcity of information, it was often not able to set ULs. It should be noted that the absence of UL does not necessarily assure freedom from developing health problems when the intake becomes excessive.

Elderly. For the aged, weakening of their masticatory function, deterioration of digestive and absorptive function, and a reduction in food intake due to less physical activities exist. Characteristics of this age group include frequent and wide variation of their individual food intake and the fact that many aged individuals are affected by an illness. Sufficient attention should be directed not only to the age but also to individual characteristics.

Pregnant and Lactating Women. First, the DRIs for non-pregnant and non-lactating women are computed for their specific age category, and then a certain amount is added for pregnancy and lactation.

The typical duration of pregnancy was assumed to be 280 days and the cumulative effect for fetal growth was expressed in terms of volume per day. If it is necessary to divide the duration of pregnancy, the following 3 divisions were proposed: early stage (less than 16 weeks); mid-stage (16 to less than 28 weeks); and late stage (28 weeks and thereafter).

For the lactating stage, data on lactation is necessary; no reliable data for Japanese women were available; so the amount of maternal milk ingested by an infant (0.78 L/day) [4] was used as the daily volume of lactation.

Because of the paucity of data on UL for pregnant and lactating women, many nutrients are without UL. The absence of UL does not necessarily assure that one is free from developing health problems due to excessive intake. It is convenient as a rule to refer to the UL for non-pregnant or non-lactating women of comparable age; however, these values did not incorporate any consideration about the effect on the fetus during pregnancy or the milk during the lactating period which may be associated with a certain risk. Thus, close attention should be paid to the UL for these women. Because the scientific basis related to these problems is not available, no quantitative reference could be provided.

BASIC APPROACH FOR APPLICATION

Basic concept of DRI-J Use

The DRIs are used for various purposes but their application may be roughly classified into the following: for the "assessment of the current state of nutrient intake" and "for designing dietary plans (including planning for dietary consultation, public nutrition and food service)." The application is further divided by whether it is for "individuals" or "groups."

Table 6. Concept of Dietary Reference Intakes uses for dietary assessment (excluding energy requirements)[1-3]

	For an Individual	For a Group
EAR	If the habitual intake is less than EAR, the probability for deficiency is more than 50%: the probability increases as the habitual intake is reduced below EAR.	The percentage of those with a habitual intake less than EAR is generally equal to that suffering from insufficient intake.
RDA	When the habitual intake exceeds the EAR and approaches RDA, the probability for deficiency is reduced. When it reaches RDA, the probability becomes low (2.5%).	Not used.
AI	If the habitual intake exceeds AI, the probability for deficiency becomes very low.	When the median intake of the group is more than AI, the percentage of those suffering from a deficiency is small. If the median intake is less than AI, the percentage cannot be determined.
DG[4]	If the habitual intake has reached DG or within the range indicated, the risk for lifestyle-related disease[6] is very unlikely.	The percentage of those not achieving DG or those with an intake outside the range corresponds to those having a risk of developing a lifestyle-related disease.[6]
UL[5]	As the habitual intake exceeds the upper limit and continues to increase, the risk for developing a disease[6] related to excessive intake increases.	The percentage of those with habitual intake exceeding UL corresponds to the percentage of those having a risk for developing a disease[6] due to excessive intake.

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; DG, tentative dietary goal for preventing lifestyle-related diseases; UL, tolerable upper intake level. [1] The assessment based on intake is meant to be used for screening. To know the true nutritional state, it is necessary to obtain clinical information, results of biochemical determinations and physiological data. [2] It has been reported in American and European studies that the energy intake (although the extent may vary in the method of survey or study subjects) is often underreported by 5 to 15%.[4)] Among Japanese, it is also known that the mean for a group be underreported by 8% than actual intake.[5)] The tendency is particularly notable when the subjects are obese;[20)] but the quantitative relationship has not been elucidated. For the nutrients, underreporting, such as seen for energy, is suspected but details are not known. [3] It is desirable that the habitual intake be estimated as accurately as possible. (Refer to 4-3.) [4] The nutrient intake and related risk for developing a lifestyle-related disease are ongoing events and should be regarded carefully. The "high" and "low" risks are relative concepts. [5] There are some nutrients for which no UL is indicated because there is no sufficient scientific basis to determine the actual value. It by no means assures safety from excessive intake. [6] The "risk" here means the probability of developing a lifestyle-related disease or disorder due to excessive consumption of the nutrient in question.

Table 7. Concept of Dietary Reference Intakes uses for dietary planning[1] (excluding energy requirements)

	For an Individual	For a Group
EAR	Not used	The percentage of those with a habitual intake below EAR should be brought down to less than 2.5%
RDA	Those whose habitual intake is less than EAR should try to achieve the RDA.	Not used
AI	One should try to bring his/her habitual intake close to AI.	The goal is to bring the mean of the group to AI.
DG[2]	One should strive to bring his/her habitual intake close to DG or within the range indicated.	Reduced the percentage of those whose habitual intake is below DG or outside the range.
UL[3]	One should bring the habitual intake below UL.	The percentage of those whose habitual intake exceeds UL should be brought to zero (0)

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; DG, tentative dietary goal for preventing lifestyle-related diseases; UL, tolerable upper intake level. [1] It is important to design and implement a plan tailored to the subject, based on a dietary assessment (using not only the dietary intake but also biochemical and physiological data). The numerical indices are not to be followed faithfully. The dietary assessment, which constitutes the basis of planning, is used for screening purposes. To understand one's true nutritional status, clinical information, results of biochemical tests and physiological data are needed. [2] The nutrient intake and related risk for developing a lifestyle-related disease are ongoing events and should be regarded carefully. The "high" and "low" risks are relative concepts. The "risk" here means the probability of developing a lifestyle-related disease or disorder due to excessive consumption of the nutrient in question. [3] There are certain nutrients for which no UL are indicated because there is no sufficient scientific basis to determine the actual value. It by no means guarantees safety from excessive intake.

Excluding energy requirements, basic handling of all nutrients is shown in Table 6 (dietary assessment) and Table 7 (dietary planning). In preparing these tables, the concept adopted in the DRIs of the United States and Canada was used as a reference.[5]

It is essential that a dietary plan be prepared and implemented, based on a dietary assessment (not only the intake but also biochemical indices and physical measurements). It should be noted that the value indicated by the DRIs are estimates and not necessarily the amount that are applicable to all circumstances in real life.

Notes for applying DRIs

1. The subjects to whom the Dietary Reference Intakes are applied are, as a rule, healthy individuals or groups that are composed of healthy individuals. The healthy individuals here may include those who have some mild conditions such as hypertension, hyperlipidemia and hyperglycemia but enjoy a normal life and no specific dietary guidance is being given or diet therapy or diet restriction is imposed.
2. Although the unit used in DRIs is "per day", it is a value for which average habitual intake is converted into a daily intake level.
3. When applying DRIs to nutritional consultation, lunch programs and others, it is especially desirable to consider the following: energy, lipids, proteins, vitamin A, vitamin B, vitamin C, calcium, iron, sodium and dietary fibers.
4. Fundamentally, RDA, AI and DG should be fulfilled through a balanced diet that is composed of normal food in daily life.
5. Regarding UL, adverse health conditions are not brought about just because the UL is exceeded temporarily through meals consisting of normal foods.
6. For aged, weakening of their masticatory function, deterioration of digestive and absorptive function, and a reduction in food intake due to less physical activities exist. This age group often has a marked variation in their individual intake and many aged individuals are affected by an illness. Thus, sufficient attention should be directed not only to the age but also to individual characteristics.

DRIS OF ENERGY AND NUTRIENTS

DRIs of energy and each nutrient in the current DRIs-J are shown in the tables of Appendix.

FUTURE ISSUES OF DRIS-J

This is the first dietary reference intake report in Japan, which applied evidence-based approach with a systematic review process. Only a few articles from within Japan and other Asian countries could be used for their establishment. The project to establish the DRI-J revealed a severe lack of scientific publications focused upon establishing DRIs for Japanese. Further research is therefore required prior to the next revision scheduled in 2010.

AUTHOR DISCLOSURES

Satoshi Sasaki, no conflicts of Interest

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[APPENDIX]

Dietary Reference Intakes (DRIs) for energy: Estimated Energy Requirements (EERs) (kcal/day)

Sex	Males			Females		
PAL	I	II	III	I	II	III
0-5 months infants						
Breastfed	-	600	-	-	550	-
Formula-fed	-	650	-	-	600	-
6-11 months	-	700	-	-	650	-
1-2 years	-	1,050	-	-	950	-
3-5	-	1,400	-	-	1,250	-
6-7	-	1,650	-	-	1,450	-
8-9	-	1,950	2,200	-	1,800	2,000
10-11	-	2,300	2,550	-	2,150	2,400
12-14	2,350	2,650	2,950	2,050	2,300	2,600
15-17	2,350	2,750	3,150	1,900	2,200	2,550
18-29	2,300	2,650	3,050	1,750	2,050	2,350
30-49	2,250	2,650	3,050	1,700	2,000	2,300
50-69	2,050	2,400	2,750	1,650	1,950	2,200
≧70[1]	1,600	1,850	2,100	1,350	1,550	1,750
Pregnant women: Early-stage (amount to be added)				+50	+50	+50
Mid-stage (amount to be added)				+250	+250	+250
Late-stage (amount to be added)				+500	+500	+500
Lactating women (amount to be added)				+450	+450	+450

PAL: Physical activity level. [1] For adults, the following formula was used for computation: Estimated Energy Requirement=Basal Metabolic Rate (kcal/day) × PAL. For those between 18～69 years, the PALs were designated as I=1.50, II=1.75 or III=2.00. For those 70 years or older, the following were used instead: I=1.30, II=1.50, III=1.70. The seeming discrepancy in Estimated Energy Requirements for the 50～69 and over 70 year group is mostly explained by this.

(Reference 1)
The description and duration of physical activity levels (ages 15 through 69 years)[1]

PAL[2]		Low (I)	Moderate (II)	High (III)
		1.50 (1.40～1.60)	1.75 (1.60～1.90)	2.00 (1.90～2.20)
Details of daily activities		Subjects remain sedentary most of the time and engage mainly in less energetic activities.	Subjects remain sedentary most of the time but the activities include any of the following: move within the work site, work performed while standing, interacting with customers, commuting, shopping, housekeeping, and light sport activities.	Subjects engage in work that require moving or remain standing; or they customarily engage in active athletic activities.
Classification of each activity (hours/day)[2]	Sleeping (1.0)	8	7～8	7
	Sedentary or being still while standing (1.5 : 1.1～1.9)	13～14	11～12	10
	Low-intensity activities such as slow walking and housekeeping (2.5 : 2.0～2.9)	1～2	3	3～4
	Mid-intensity activities such as exercise or labor that can be sustained for an extended period (includes normal speed walking) (4.5 : 3.0～5.9)	1	2	3
	Highly-intensity activities, such as exercise or labor that requires frequent rest (7.0 : >6.0)	0	0	0～1

PAL, Physical activity level. [1] Representative values. The range is shown in parentheses. [2] Data in parentheses is an activity factor (Af: intensity per unit time of each physical activity, expressed in a multiple of the basal metabolism). (Representative value: lower threshold～upper threshold).

(Reference 2)
Examples of physical activity classifications

Classification of physical activities (within the range of Af[1])	Examples of physical activities
Sleeping (1.0)	Sleeping
Sedentary activities while sitting or standing (1.1～1.9)	Lying down, sit in a relaxed manner (reading books, writing, and watching television), carrying on a conversation (while standing), cooking, dining, toileting activities (dressing, face-washing, and using the toilet facilities), sewing (hand-sewing and operating a sewing machine), engaging in a hobby or entertainment (flower arrangement, tea ceremony, mah-jong, playing musical instrument), driving, desk work (book-keeping and operating a word processor and OA equipment).
Low-intensity activities, such as slow walking or household chores (2.0～2.9)	Standing in a train or bus. Walk slowly for shopping or just enjoy a walk (45 m/min.). Doing laundry (using a washing machine). House cleaning (using a vacuum cleaner).
Mid-intensity exercise or labor that can be sustained for an extended period (including normal walking) (3.0～5.9)	Tend a home vegetable garden. Play gate-ball. Normal walking (71 m/min.). Bathing. Cycling (at a normal speed). Walking with a child on one's back. Playing catch-ball. Playing golf. Dancing (light). Hiking (on level ground). Climbing up and down stairs. Lifting or taking down bedding. Normal walking (95 m/min). Gymnastics (following radio or television instructions).
High-intensity activities such as exercise or labor that require frequent rest (>6.0)	Muscle training, aerobic dancing (active), rowing, jogging (120 m/min), tennis, badminton, volleyball, skiing, basketball, soccer, skating, jogging (160 m/min), swimming, running (200 m/min).

[1] Activity factor (Af) is computed from the relative metabolic rate cited by Numajiri[45] as follows: Af=energy metabolic rate+1.2. Each physical activity was based on the mean during the time of activity. The data during rest and interruption were excluded.

Dietary Reference Intakes (DRIs) for protein

Sex	Males				Females			
Age	EAR (g/day)	RDA (g/day)	AI (g/day)	DG (% energy)[1]	EAR (g/day)	RDA (g/day)	AI (g/day)	DG (% energy)[1]
0-5 months infants								
Breastfed	-	-	10	-	-	-	10	-
Formula-fed	-	-	15	-	-	-	15	-
6-11 months infants								
Breastfed	-	-	15	-	-	-	15	-
Formula-fed	-	-	20	-	-	-	20	-
1-2 years	15	20	-	-	15	20	-	-
3-5	20	25	-	-	20	25	-	-
6-7	30	35	-	-	25	30	-	-
8-9	30	40	-	-	30	40	-	-
10-11	40	50	-	-	40	50	-	-
12-14	50	60	-	-	45	55	-	-
15-17	50	65	-	-	40	50	-	-
18-29	50	60	-	<20	40	50	-	<20
30-49	50	60	-	<20	40	50	-	<20
50-69	50	60	-	<20	40	50	-	<20
≧ 70	50	60	-	<25	40	50	-	<25
Pregnant women (amount to be added)					+8	+10	-	-
Lactating women (amount to be added)					+15	+20	-	-

[1] The TGs (upper threshold) were set as protein energy ratio (%). EAR, estimated average requirement, RDA, recommended dietary allowance; AI, adequate intake; DG, tentative dietary goal for preventing life-style related diseases

Dietary Reference Intakes (DRIs) for fat

	Total fat (% energy)				Saturated fatty acids (% energy)	
	Male		Females		Males	Females
	AI	DG	AI	DG	AI	AI
0-5 months	50	-	50	-	-	-
6-11	40	-	40	-	-	-
1-2 years	-	20<, <30	-	20<, <30	-	-
3-5	-	20<, <30	-	20<, <30	-	-
6-7	-	20<, <30	-	20<, <30	-	-
8-9	-	20<, <30	-	20<, <30	-	-
10-11	-	20<, <30	-	20<, <30	-	-
12-14	-	20<, <30	-	20<, <30	-	-
15-17	-	20<, <30	-	20<, <30	-	-
18-29	-	20<, <30	-	20<, <30	4.5<, <7.0	4.5<, <7.0
30-49	-	20<, <25	-	20<, <25	4.5<, <7.0	4.5<, <7.0
50-69	-	20<, <25	-	20<, <25	4.5<, <7.0	4.5<, <7.0
≧ 70[1]	-	15<, <25	-	15<, <25	4.5<, <7.0	4.5<, <7.0
Pregnant women			-	20<, <30		4.5<, <7.0
Lactating women			-	20<, <30		4.5<, <7.0

AI, adequate intake; DG, tentative dietary goal for preventing life-style related diseases. Saturated fatty acid: C4:0, C6:0, C8:0, C10:0, C12:0, C14:0, C15:0, C16:0, C17:0, C18:0, C20:0, C22:0, C24:0. Note: When the subject is ≥10 years old and the blood LDL cholesterol level is high, the arteriosclerotic process may progress. Treatment that includes restriction on saturated fatty acids is desired.

Dietary Reference Intakes (DRIs) for fat

	n-6 fatty acids[1]				n-3 fatty acids[2] (g/day)				Cholesterol[3] (mg/day)	
	Males		Females		Males		Females		Males	Females
	AI (g/day)	DG (% energy)	AI (g/day)	DG (% energy)	AI	DG	AI	DG	DG	DG
0-5 months	4.0	-	4.0	-	0.9	-	0.9	-	-	-
6-11	5.0	-	5.0	-	1.0	-	1.0	-	-	-
1-2 years	6.0		6.0		1.1	-	1.0	-	-	-
3-5	8.0		7.0		1.5	-	1.5	-	-	-
6-7	9.0		8.5		1.6	-	1.6	-	-	-
8-9	9.0		10		1.9	-	2.0	-	-	-
10-11	11		11		2.1	-	2.1	-	-	-
12-14	13		10		2.6	-	2.1	-	-	-
15-17	14		11		2.8	-	2.3	-	-	-
18-29	12	<10	10	<10	-	>2.6	-	>2.2	<750	<600
30-49	11	<10	9.5	<10	-	>2.6	-	>2.2	<750	<600
50-69	10	<10	9.0	<10	-	>2.9	-	>2.5	<750	<600
≧ 70[1]	8.0	<10	7.0	<10	-	>2.2	-	>2.0	<750	<600
Pregnant women			9.0	<10			2.1	-		<600
Lactating women			10	<10			2.4	-		<600

AI, adequate intake; DG, tentative dietary goal for preventing life-style related diseases. [1] N-6 fatty acids: C16:3, C18:2, C18:3, C20:2, C20:3, C20:4, C22:2, C22:5. No goal was computed for children; but by using the values set for an adult, it is desirable to avoid excessive intake. [2] N-3 fatty acids: C18:3, C18:4, C20:4, C20:5, C22:5, C22:6. [3] When the subject is ≥10 years-old and the blood LDL cholesterol level is high, the arteriosclerotic process may progress. Treatment that includes restriction on cholesterol intake is desired.

Dietary Reference Intakes (DRIs) for carbohydrates (% energy)

Sex	Males					Females				
Age	EAR	RDA	AI	DG	UL	EAR	RDA	AI	DG	UL
0-5 months	-	-	-	-	-	-	-	-	-	-
6-11	-	-	-	-	-	-	-	-	-	-
1-2 years	-	-	-	-	-	-	-	-	-	-
3-5	-	-	-	-	-	-	-	-	-	-
6-7	-	-	-	-	-	-	-	-	-	-
8-9	-	-	-	-	-	-	-	-	-	-
10-11	-	-	-	-	-	-	-	-	-	-
12-14	-	-	-	-	-	-	-	-	-	-
15-17	-	-	-	-	-	-	-	-	-	-
18-29	-	-	-	50<, <70	-	-	-	-	50<, <70	-
30-49	-	-	-	50<, <70	-	-	-	-	50<, <70	-
50-69	-	-	-	50<, <70	-	-	-	-	50<, <70	-
≧ 70	-	-	-	50<, <70	-	-	-	-	50<, <70	-
Pregnant women (amount to be added)						-	-	-	-	—
Lactating women (amount to be added)						-	-	-	-	—

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

Dietary Reference Intakes (DRIs) for dietary fibers (g/day)

Sex	Males					Females				
Age	EAR	RDA	AI	DG	UL	EAR	RDA	AI	DG	UL
0-5 months	-	-	-	-	-	-	-	-	-	-
6-11	-	-	-	-	-	-	-	-	-	-
1-2 years	-	-	-	-	-	-	-	-	-	-
3-5	-	-	-	-	-	-	-	-	-	-
6-7	-	-	-	-	-	-	-	-	-	-
8-9	-	-	-	-	-	-	-	-	-	-
10-11	-	-	-	-	-	-	-	-	-	-
12-14	-	-	-	-	-	-	-	-	-	-
15-17	-	-	-	-	-	-	-	-	-	-
18-29	-	-	27	20	-	-	-	21	17	-
30-49	-	-	26	20	-	-	-	20	17	-
50-69	-	-	24	20	-	-	-	19	18	-
≧ 70	-	-	19	17	-	-	-	15	15	-
Pregnant women (amount to be added)						-	-	-	-	-
Lactating women (amount to be added)						-	-	-	-	-

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

Dietary Reference Intakes (DRIs) for vitamin B_1 (mg/day)[1]

Sex	Males				Females			
Age	EAR	RDA	AI	UL	EAR	RDA	AI	UL
0-5 months	-	-	0.1	-	-	-	0.1	-
6-11	-	-	0.3	-	-	-	0.3	-
1-2 years	0.4	0.5	-	-	0.4	0.5	-	-
3-5	0.6	0.7	-	-	0.6	0.7	-	-
6-7	0.7	0.9	-	-	0.7	0.8	-	-
8-9	0.9	1.1	-	-	0.8	1.0	-	-
10-11	1.0	1.2	-	-	1.0	1.2	-	-
12-14	1.2	1.4	-	-	1.0	1.2	-	-
15-17	1.2	1.5	-	-	1.0	1.2	-	-
18-29	1.2	1.4	-	-	0.9	1.1	-	-
30-49	1.2	1.4	-	-	0.9	1.1	-	-
50-69	1.1	1.3	-	-	0.9	1.0	-	-
≧ 70	0.8	1.0	-	-	0.7	0.8	-	-
Pregnant women (amount to be added)								
early-stage					+0	+0	-	-
mid-stage					+0.1	+0.1	-	-
late-stage					+0.2	+0.3	-	-
Lactating women (amount to be added)					+0.1	+0.1	-	-

[1] Computed using the Estimated Energy Requirement for PAL II. EAR, estimated average requirement, RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level; PAL, physical activity level

Dietary Reference Intakes (DRIs) for vitamin B_2 (mg/day)[1]

Sex	Males				Females			
Age	EAR	RDA	AI	UL	EAR	RDA	AI	UL
0-5 months	-	-	0.3	-	-	-	0.3	-
6-11	-	-	0.4	-	-	-	0.4	-
1-2 years	0.5	0.6	-	-	0.4	0.5	-	-
3-5	0.7	0.8	-	-	0.6	0.8	-	-
6-7	0.8	1.0	-	-	0.7	0.9	-	-
8-9	1.0	1.2	-	-	0.9	1.1	-	-
10-11	1.2	1.4	-	-	1.1	1.3	-	-
12-14	1.3	1.6	-	-	1.2	1.4	-	-
15-17	1.4	1.7	-	-	1.1	1.3	-	-
18-29	1.3	1.6	-	-	1.0	1.2	-	-
30-49	1.3	1.6	-	-	1.0	1.2	-	-
50-69	1.2	1.4	-	-	1.0	1.2	-	-
≧ 70	0.9	1.1	-	-	0.8	0.9	-	-
Pregnant women (amount to be added)								
early-stage					+0	+0	-	-
mid-stage					+0.1	+0.2	-	-
late-stage					+0.3	+0.3	-	-
Lactating women (amount to be added)					+0.3	+0.4	-	-

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level; PAL, physical activity level

Dietary Reference Intakes (DRIs) for niacin (mg NE/day)[1]

Sex	Males				Females			
Age	EAR	RDA	AI	UL[2]	EAR	RDA	AI	UL[2]
0-5 months[3]	-	-	2	-	-	-	2	-
6-11	-	-	3	-	-	-	3	-
1-2 years	5	6	-	-	4	5	-	-
3-5	7	8	-	-	6	7	-	-
6-7	8	10	-	-	7	9	-	-
8-9	9	11	-	-	9	10	-	-
10-11	11	13	-	-	10	12	-	-
12-14	13	15	-	-	11	13	-	-
15-17	13	16	-	-	11	13	-	-
18-29	13	15	-	300 (100)	10	12	-	300 (100)
30-49	13	15	-	300 (100)	10	12	-	300 (100)
50-69	12	14	-	300 (100)	9	11	-	300 (100)
≧ 70	9	11	-	300 (100)	7	9	-	300 (100)
Pregnant women (amount to be added)								
early-stage					+0	+0	-	-
mid-stage					+1	+1	-	-
late-stage					+2	+3	-	-
Lactating women (amount to be added)					+2	+2	-	-

NE, niacin equivalents; EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level, PAL, physical activity level. [1] Computed using the Estimated Energy Requirement for PAL II. [2] Quantity (mg) for the upper threshold of nicotinamide. The value in parentheses is the quantity (mg) of nicotinic acid. [3] Unit, mg/day

Dietary Reference Intakes (DRIs) for vitamin B_6 (mg/day)[1]

Sex	Males				Females			
Age	EAR	RDA	AI	UL[2]	EAR	RDA	AI	UL[2]
0-5 months	-	-	0.2	-	-	-	0.2	-
6-11	-	-	0.3	-	-	-	0.3	-
1-2 years	0.4	0.5	-	-	0.4	0.5	-	-
3-5	0.5	0.6	-	-	0.5	0.6	-	-
6-7	0.7	0.8	-	-	0.6	0.7	-	-
8-9	0.8	0.9	-	-	0.8	0.9	-	-
10-11	1.0	1.2	-	-	1.0	1.2	-	-
12-14	1.1	1.4	-	-	1.0	1.3	-	-
15-17	1.2	1.5	-	-	1.0	1.2	-	-
18-29	1.1	1.4	-	60	1.0	1.2	-	60
30-49	1.1	1.4	-	60	1.0	1.2	-	60
50-69	1.1	1.4	-	60	1.0	1.2	-	60
≧ 70	1.1	1.4	-	60	1.0	1.2	-	60
Pregnant women (amount to be added)					+0.7	+0.8	-	-
Lactating women (amount to be added)					+0.3	+0.3	-	-

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level, PAL, physical activity level. [1] Computed using the Estimated Energy Requirement for PAL II. [2] Quantity as pyridoxine.

Dietary Reference Intakes (DRIs) for folic acid (μg/day)[1]

Sex	Males				Females			
Age	EAR	RDA	AI	UL[2]	EAR	RDA	AI	UL[2]
0-5 months	-	-	40	-	-	-	40	-
6-11	-	-	60	-	-	-	60	-
1-2 years	80	90	-	-	80	90	-	-
3-5	90	110	-	-	90	110	-	-
6-7	110	140	-	-	110	140	-	-
8-9	140	160	-	-	140	160	-	-
10-11	160	200	-	-	160	200	-	-
12-14	200	240	-	-	200	240	-	-
15-17	200	240	-	-	200	240	-	-
18-29	200	240	-	1,000	200	240	-	1,000
30-49	200	240	-	1,000	200	240	-	1,000
50-69	200	240	-	1,000	200	240	-	1,000
≧70	200	240	-	1,000	200	240	-	1,000
Pregnant women (amount to be added)					+170	+200	-	–
Lactating women (amount to be added)					+80	+100	-	–

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level. [1] Intake of 400 μg/day is desired for women who are planning to get pregnant or may be pregnant to reduce the risk of neural tube closure. [2] Quantity as pteroyl-monoglutamic acid (intake from sources other than ordinary food).

Dietary Reference Intakes (DRIs) for vitamin B_{12} (g/day)

Sex	Males				Females			
Age	EAR	RDA	AI	UL[1]	EAR	RDA	AI	UL[1]
0-5 months	-	-	0.2	-	-	-	0.2	-
6-11	-	-	0.5	-	-	-	0.5	-
1-2 years	0.8	0.9	-	-	0.8	0.9	-	-
3-5	0.9	1.1	-	-	0.9	1.1	-	-
6-7	1.2	1.4	-	-	1.2	1.4	-	-
8-9	1.4	1.6	-	-	1.4	1.6	-	-
10-11	1.6	2.0	-	-	1.6	2.0	-	-
12-14	2.0	2.4	-	-	2.0	2.4	-	-
15-17	2.0	2.4	-	-	2.0	2.4	-	-
18-29	2.0	2.4	-	-	2.0	2.4	-	-
30-49	2.0	2.4	-	-	2.0	2.4	-	-
50-69	2.0	2.4	-	-	2.0	2.4	-	-
≧ 70	2.0	2.4	-	-	2.0	2.4	-	-
Pregnant women (amount to be added)					+0.3	+0.4	-	-
Lactating women (amount to be added)					+0.3	+0.4	-	-

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level. [1] The ULs were not set: even if it is taken in excess, the intrinsic factor secreted from the stomach becomes saturated and excess vitamin B_{12} is not absorbed.

Dietary Reference Intakes (DRIs) for biotin (μg/day)

Sex	Males				Females			
Age	EAR	RDA	AI	UL	EAR	RDA	AI	UL
0-5 months	-	-	4	-	-	-	4	-
6-11	-	-	10	-	-	-	10	-
1-2 years	-	-	20	-	-	-	20	-
3-5	-	-	25	-	-	-	25	-
6-7	-	-	30	-	-	-	30	-
8-9	-	-	35	-	-	-	35	-
10-11	-	-	40	-	-	-	40	-
12-14	-	-	45	-	-	-	45	-
15-17	-	-	45	-	-	-	45	-
18-29	-	-	45	-	-	-	45	-
30-49	-	-	45	-	-	-	45	-
50-69	-	-	45	-	-	-	45	-
≧ 70	-	-	45	-	-	-	45	-
Pregnant women (amount to be added)					-	-	+2	—
Lactating women (additional value)					-	-	+4	—

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level