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Food Sources of Weight, Calories, and Three Macro-nutrients — NAHSIT 1993-1996

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Abstract

The purpose of this study was to understand how various food groups contributed to food weights, calories, and three macro-nutrients in Taiwanese diet, using data from the Nutrition and Health Survey in Taiwan (NAHSIT) gathered during July, 1993 to June, 1996. Among 9,962 samples, 3,915 24-hour recalls were obtained from sampled adults aged 19 to 64. Foods consumed daily weighed on average 1,821 g and 1,373 g for males and females, respectively. In terms of food weights, the major food groups consumed by males were refreshment and snacks; vegetables; and cereals, grains, tubers, and roots; while the major food groups consumed by females were vegetables; fruits; and cereals, grains, tubers, and roots. Cereals, grains, tubers, and roots and meats were the two major calorie sources for both males and females. Food groups such as refreshments and snacks; protein foods other than meat, and fish; and fats and oils provided less but substantial amount of calories. In the analyses of food sources of macro-nutrients, we found that the Taiwanese diet provided for men 13.2 exchanges of cereals, grains, tubers, or roots (approximating 3.3 bowls of rice); 1 tablespoon of cooking fats or oils; 6.4 exchanges of meats, fish, legumes, or eggs; 0.3 exchange of dairy products; 3 exchanges of vegetables; and 1 exchange of fruits. It provided for women 9 exchanges of cereals, grains, tubers, or roots (approximating 2.3 bowls of rice); 1 tablespoon of cooking fats or oils; 4.5 exchanges of meats, fish, legumes, or eggs; 0.4 exchange of dairy products; 3 exchanges of vegetables; and 1.2 exchanges of fruits. Comparing to Taiwan dietary guidelines, these dietary patterns were adequate in vegetable consumption, high in the meats, fish, legumes, and eggs group but low in the cereals, grains, tubers, and roots; fruits; and dairy groups.

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Although the data showed a mean of 1 tablespoon of cooking oils and fats consumed by each individual, dietary fat in Taiwanese diet was above the upper ceiling of the recommended 30% of total calories. This was probably due to relatively low carbohydrate intake and increased consumption of invisible fats and processed / purchased foods in which fats and oils could not be easily quantified. The pork and pork products group was the major contributor of not only dietary protein but also fat. Carbohydrate intake primarily came from food categories of cereals, grains, tubers, and roots; refreshment and snack foods; and fruits in that order. Therefore, modification should be considered to reduce the amount and the fat content of the pork products consumed, to replace empty calories of refreshment and snack by cereals and grains, and to increase dairy products, and fruits to achieve a more balanced diet for Taiwanese. In addition, pragmatic consideration should be given to the daily dietary guidelines concerning the fats and oils and related food groups.

Key words: food weight, calories, macro-nutrients, nutrition survey, food sources of nutrients, Taiwan

Introduction

Quantitative information on the major contributing foods to food weight, calories, fat, protein, and fat is of great value for public health nutrition educators, policy makers, and epidemiologists who investigate the relations between diet and diseases. In 1985, Block et al. (1,2) listed the major foods contributing to dietary nutrient intakes in the US population. These data, based on the NHANES II survey, provided quantitative information on dietary patterns of the US population. In Italy where culinary delicacies are emphasized, Freudenheim et al. (3,4) has also studied food sources of nutrients for the Italian elderly population. Pan et al. (5-7) made a thorough analysis and discussion about the major food sources of the various nutrients consumed by people in Taiwan, using data of the first National Nutrition Survey collected by Huang et al in 1980 and 1981. Using data from the second National Nutrition Survey in Taiwan area conducted from 1986 to 1988, Lee et al. (8) analyzed the weights and percent weights of various kinds of foods consumed. The quantitative details and the purposes of these studies varied considerably. The present study made use of the 24-hour recall data from the recent Nutrition and Health Survey in Taiwan (NAHSIT), to understand how various food groups contributed to food weights, calories, and three macro-nutrients in Taiwanese diet. In addition, the amounts of carbohydrate, lipid, and protein provided by various food groups were converted into equivalents of food exchange and compared with those recommended in the Daily Dietary Guidelines of the Department of Health (DOH). These results can provide information to the public health nutrition educators and policy makers as to how to adjust food sources of the Taiwanese in order to achieve a balanced diet.

Materials and Methods

Research design and sampling

NAHSIT adopted a multi-staged, stratified, clustered, probability sampling scheme. The independent samples of 9,962 were collected from 21 townships of Taiwan, 3 each from each of the seven strata. Details on sampling scheme has been described elsewhere (9). 24-hour recall was carried out only in participants aged 13-64. The data used in this study included 3,915 respondents aged 19 to 64 (1,963 males and 1,952 females). Pregnant or breast-feeding women and those who had extraordinary dietary values were excluded from the final analysis.

Procedure and analytical steps for 24-h recall data

This survey applied the method of 24-hour recall, inquiring about the family recipes for all cooked dishes as well as food and dish items and quantities consumed by sampled individuals. Four abstract models, 12 food-piece models, and standard cooking measures, and weights were used to quantify the amounts of foods consumed. The acquired information was converted to food weights by a computing system developed by the Institute of Biomedical Sciences, Academia Sinica. The details of the models and computing system have been described elsewhere (10). The weights of foods consumed by an average individual were then combined by 12 food groups (Table 1). Sub-grouping was also carried out in each of the 12 groups. Nutrient Composition Data Bank for Foods of Taiwan Area developed by the Food Industry Research and Development Institute (11) was used to calculate levels of calories and three macro-nutrients in various food groups.

SAS and Excel were used to analyze the data. A weighting process was used to compute means and standard errors of all variables. Details on sample weight generation has been described elsewhere (9).

Results

Amounts of foods consumed

Average weights of individual food groups consumed daily by male and female adults are listed in Tables 1 and 2. The average food weights consumed by males and females were 1,821 g and 1,373 g, respectively. For males, the foods of the highest weight were refreshment and snack group (360 g, representing 19.8% of all foods); followed by vegetables (323 g, 17.8%); cereals, grains, tubers, and roots (270 g, 14.8%); and fruits (179 g, 9.8%). For females, food group of the highest weight was vegetables (324 g, representing 23.6% of all foods); followed by fruits (216 g, 15.8%); cereals, grains, tubers, and roots (197 g, 14.3%); and refreshment and snacks (195 g, 14.2%).

Similar to the finding of the previous two national nutrition surveys, rice and rice products group was the major subgroup in the cereals, grains, tubers, and roots group. Their weights were 210 g (11.5%) for males and 129 g (9.4%) for females. As

to fats and oils group, males and females both consumed an average amount of 18 g daily. Among the 18 g, 11.1 g (0.6%) was from vegetable oils in men and 12.5 g (0.9 %) in females. Males consumed 3 g (0.2%) of animal fats and females consumed 2.8 g (0.2%).

In terms of protein-rich foods, pork and pork products group was the major food source. Males consumed 126 g (6.9%) and females consumed 88 g (6.4%) daily. The next important subgroup was chicken and chicken products; 52 g (2.9%) for males and 31 g (2.3%) for females. Males consumed 97 g (5.3%) and females 74 g (5.4%) of seafood. Males consumed 34 g (1.9%) of eggs and egg products and females consumed 27 g (1.9%). Dairy products for males were 56 g (3.1%) and 58 g (4.3%) for females. Soybeans and soybean products were 79 g (4.3%) for males and 47 g (3.4%) for females, respectively. These results indicate that men consumed more soybeans and soybean products than women in terms of percentage. On the contrary, women ingested more dairy products than men. Other protein rich foods did not differ much between men and women in terms of percentage.

With regard to vegetable group, both men and women consumed 323 g, which is equivalent to 3 exchanges. But the percentage of vegetable consumption in women (23.6%) was higher than that of men (17.8%). Dark-green and deep-yellow vegetables were the major vegetables consumed, weighing 153 g. Women's consumption level of fruits (216 g, 15.8%) was higher than that of men's (179 g, 9.8%). As to refreshment and snacks, men consumed 360 g (19.8%) and women 195 g (14,2%). This men-women difference in the amount of refreshment and snacks was due primarily to that men took more sweetened crushed ice and sugary drinks (291 g, 16.0%) than women (148 g, 10.8%). Regarding alcoholic beverages, men's consumption was 94 g (5.1%) and women's 11 g (0.8%).

Contribution of food groups to calories

Table 1 and Table 2 showed that adults relied on cereals, grains, tubers, and roots as their primary energy source: 792 kcal for males (36% of the total energy) and 513 kcal for females (32.3% of the total energy). The secondary energy source was meat group, which provided 392 kcal for males (17.8%) and 245 kcal for females (15.4%). Other major energy contributors for males were refreshments and snacks category, 184 kcal (8.4%); other protein-rich foods, 170 kcal (7.7%); fats and oils, 139 kcal (6.3%) in that order. For females, other major energy contributors were other protein-rich foods, 154 kcal (9.7%); fats and oils, 146 kcal (9.2%); and refreshments and snacks, 143 kcal (9.1%).

Refreshments and snacks contributed substantially to the energy supply. They provided in men 184 kcal (8.4%) and in women 144 kcal (9.1%). The energy percentage of this category was almost equal to that of fats and oils. For men, major refreshments and snack foods came from sugary crushed ice and sugary drinks, 154 kcal (3%), followed by cakes, cookies and pastries, 63 kcal (2.8%). For women, the main foods of refreshments and snack foods are cakes, cookies and pastries, which provided 66 kcal (4.2%), while sugary crushed ice and sugary drinks provided 34 kcal (2.1%).

Table 1 The daily amount of each kind of food and its energy consumed by male adults in Taiwan area, NAHSIT 1993-1996

Food categories	Food weight (g)			Calories (kcal)		
	Mean	SD	%	Mean	SD	%
Total amount of foods	1821.1		100%	2199.7		100%
Cereals, grains, tubers, and roots (A)	269.8		14.8%	791.7		36.0%
Rice and rice products (A1)	209.6	146.2	11.5%	678.1	428.7	30.8%
Wheat and flour products (A2)	39.1	94.5	2.1%	97.5	219.8	4.4%
Starchy roots and stems (A3)	21.2	89.9	1.2%	16.1	66.3	0.7%
Starch-rich beans (A4)	2.1	13.4	0.1%	6.8	44.4	0.3%
Fats and oils (B)	18.3		1.0%	139.4		6.3%
Vegetable oils (B1)	11.1	21.9	0.6%	99.1	197.0	4.5%
Animal fats (B2)	3.0	18.0	0.2%	27.0	161.7	1.2%
Nuts and nut products (B3)	4.2	23.1	0.2%	13.3	63.0	0.6%
Poultry (C)	65.2		3.6%	51.2		2.3%
Chicken and chicken products (C1)	52.2	137.0	2.9%	43.8	108.4	2.0%
Duck and duck products (C2)	9.2	52.0	0.5%	4.2	24.1	0.2%
Other related poultry products (C3)	3.8	30.8	0.2%	3.3	26.3	0.1%
Meat (D)	137.4		7.5%	392.2		17.8%
Pork and pork products (D1)	126.2	182.8	6.9%	374.9	836.7	17.0%
Beef and beef products (D2)	7.9	36.3	0.4%	12.3	58.9	0.6%
Other related meat products (D3)	3.3	27.5	0.2%	5.0	42.5	0.2%
Seafood (E)	96.9		5.3%	76.4		3.5%
Freshwater fish (fresh) (E1)	29.0	141.6	1.6%	19.3	87.9	0.9%
Saltwater fish (fresh) (E2)	34.4	111.1	1.9%	30.5	89.3	1.4%
Fish products and fish organs (E3)	5.4	24.3	0.3%	9.9	46.3	0.4%
Shellfish and shellfish products (E4)	28.1	89.2	1.5%	16.8	45.2	0.8%
Other protein-rich foods (F)	169.0		9.3%	170.4		7.7%
Eggs and egg products (F1)	34.3	50.0	1.9%	42.0	61.2	1.9%
Dairy products (F2)	55.9	156.3	3.1%	54.5	161.5	2.5%
Soybean and soybean products (F3)	78.9	146.4	4.3%	73.9	139.5	3.4%
Vegetables (G)	323.1		17.7%	69.3		3.1%
Dark-green and deep-yellow vegetables (G1)	152.6	209.3	8.4%	28.1	36.9	1.3%
Light-color vegetables (G2)	84.9	130.9	4.7%	16.7	27.8	0.8%
Bamboo shoots (G3)	18.8	76.2	1.0%	2.6	10.0	0.1%
Squash (G4)	42.8	107.1	2.4%	6.3	17.7	0.3%
Beans (G5)	3.8	15.4	0.2%	1.5	7.2	0.1%
Mushrooms (G6)	3.3	15.2	0.2%	1.2	7.3	0.1%
Pickles (G7)	14.2	49.0	0.8%	7.5	25.4	0.3%
Seaweed (G8)	2.7	13.7	0.1%	5.3	27.7	0.2%

Table 1 The daily amount of each kind of food and its energy consumed by male adults in Taiwan area, NAHSIT 1993-1996 (Cont.)

Food categories	Food weight (g)			Calories (kcal)		
	Mean	SD	%	Mean	SD	%
Fruits (H)	178.5		9.8%	59.5		2.7%
Fresh fruits (H1)	172.1	416.1	9.5%	55.8	134.9	2.5%
Processed fruits (H2)	1.5	14.8	0.1%	1.8	19.7	0.1%
Fresh fruit juices (H3)	4.9	55.6	0.3%	1.9	20.0	0.1%
Refreshment and snacks (I)	360.4		19.8%	183.8		8.4%
Breads (I1)	10.6	41.2	0.6%	32.4	130.4	1.5%
Pastries, and cookies (I2)	17.4	69.6	1.0%	62.7	233.6	2.8%
Candy (chocolate) (I3)	0.5	5.1	0.0%	2.6	26.3	0.1%
Sweetened crushed ice and sugary drinks (I4)	291.5	572.4	16.0%	66.0	153.5	3.0%
Processed juices (I5)	35.8	139.0	2.0%	15.0	59.3	0.7%
Jellies, puddings (I6)	4.69	42.78	0.3%	5.16	69.35	0.2%
Alcoholic beverages(J)	93.5		5.1%	94.4		4.3%
Alcoholic beverages (J)	93.5	357.2	5.1%	94.4	312.5	4.3%
Sauces, condiments and spices (K)	61.0		3.3%	58.5		2.7%
Sugar (K1)	6.6	40.3	0.4%	16.6	87.2	0.8%
Salt (K2)	2.7	5.2	0.1%	0	0.02	0.0%
Soy sauce (K3)	8.7	48.7	0.5%	8.0	45.6	0.4%
Other spice (K4)	43.0	347.8	2.4%	33.9	135.4	1.5%
Miscellaneous foods (L)	47.1		2.6%	109.5		5.0%
Instant noodles (L1)	8.5	36.7	0.5%	40.1	173.7	1.8%
Sandwiches, hamburger (L2)	5.4	24.6	0.3%	13.0	59.4	0.6%
Steamed buns and meat dumplings (L3)	16.5	53.8	0.9%	38.0	120.1	1.7%
Soups (L4)	9.9	63.1	0.5%	3.2	37.1	0.1%
Others (L5)	6.9	34.6	0.4%	15.2	83.4	0.7%

1,963 samples, 19-64 years old. Food weight is coverted to that of "raw" and "as purchased" form; % indicates contribution to daily total; standard deviation, SD. Food Categories have been previously defined (13).

Table 2 The daily amount of each kind of food and its energy consumed by female adults in Taiwan area, NAHSIT 1993-1996

Food categories	Food weight (g)			Calories (kcal)		
	Mean	SD	%	Mean	SD	%
Total amount of foods	1373.0		100%	1588.3		100%
Cereals, grains, tubers, and roots (A)	196.7		14.3%	513.4		32.3%
Rice and rice products (A1)	129.4	111.8	9.4%	397.3	309.8	25.0%
Wheat and flour products (A2)	38.3	123.0	2.8%	94.1	365.4	5.9%
Starchy roots and stems (A3)	29.0	99.1	2.1%	22.1	67.9	1.4%
Starch-rich beans (A4)	1.7	8.6	0.1%	5.7	28.5	0.4%
Fats and oils (B)	184		1.3%	146.3		9.2%
Vegetable oils (B1)	12.5	21.6	0.9%	111.9	193.2	7.0%
Animal fats (B2)	2.8	14.1	0.2%	24.8	126.6	1.6%
Nuts and nut products (B3)	3.0	18.9	0.2%	9.7	56.1	0.6%
Poultry (C)	37.2		2.7%	30.1		1.9%
Chicken and chicken products (C1)	31.1	129.2	2.3%	26.3	96.0	1.7%
Duck and duck products (C2)	3.5	18.6	0.3%	1.7	9.9	0.1%
Other related poultry products (C3)	2.7	28.5	0.2%	2.1	22.6	0.1%
Meat (D)	92.7		6.7%	244.6		15.4%
Pork and pork products (D1)	88.2	138.0	6.4%	237.9	777.3	15.0%
Beef and beef products (D2)	3.1	19.5	0.2%	4.6	28.5	0.3%
Other related meat products (D3)	1.3	14.4	0.1%	2.0	22.1	0.1%
Seafood (E)	74.2		5.4%	56.9		3.6%
Freshwater fish (fresh) (E1)	19.3	82.1	1.4%	11.2	68.4	0.7%
Saltwater fish (fresh) (E2)	21.1	56.6	1.5%	18.8	50.4	1.2%
Fish products and fish organs (E3)	5.2	21.6	0.4%	9.5	39.3	0.6%
Shellfish and shellfish products (E4)	28.5	121.8	2.1%	17.4	67.5	1.1%
Other protein-rich foods (F)	131.7		9.6%	154.0		9.7%
Eggs and egg products (F1)	26.7	49.6	1.9%	33.1	61.0	2.1%
Dairy products (F2)	58.5	157.3	4.3%	64.9	155.9	4.1%
Soybean and soybean products (F3)	46.5	93.5	3.4%	56.1	116	3.5%
Vegetables (G)	323.8		23.6%	70.3		4.4%
Dark-green and deep-yellow vegetables (G1)	153.8	215.5	11.2%	27.4	37.5	1.7%
Light-color vegetables (G2)	79.3	147.2	5.8%	15.5	27.9	1.0%
Bamboo shoots (G3)	17.6	60.9	1.3%	2.6	8.8	0.2%
Squash (G4)	49.2	137.0	3.6%	7.6	23.7	0.5%
Beans (G5)	3.8	14.8	0.3%	1.5	7.9	0.1%
Mushrooms (G6)	2.8	12.1	0.2%	1.3	7.9	0.1%
Pickles (G7)	13.9	41.0	1.0%	7.8	29.5	0.5%
Seaweed (G8)	3.4	15.1	0.2%	6.7	29.8	0.4%

Table 2 The daily amount of each kind of food and its energy consumed by female adults in Taiwan area, NAHSIT 1993-1996 (Cont.)

Food categories	Food weight (g)			Calories (kcal)		
	Mean	SD	%	Mean	SD	%
Fruits (H)	**216.3**		**15.8%**	**74.7**		**4.7%**
Fresh fruits (H1)	208.3	350.5	15.2%	69.4	119.6	4.4%
Processed fruits (H2)	2.9	22.2	0.2%	2.9	19.9	0.2%
Fresh fruit juices (H3)	5.1	45.1	0.4%	2.4	21.6	0.1%
Refreshment and snacks (I)	**195.3**		**14.2%**	**143.8**		**9.1%**
Breads (I1)	10.1	28.8	0.7%	30.2	84.8	1.9%
Pastries, and cookies (I2)	18.8	62.3	1.4%	66.1	200.7	4.2%
Candy (chocolate) (I3)	0.7	8.8	0.1%	3.5	48.0	0.2%
Sweetened crushed ice and sugary drinks (I4)	148.3	345.5	10.8%	33.7	87.2	2.1%
Processed juices (I5)	13.6	67.9	1.0%	5.5	27.5	0.3%
Jellies, puddings (I6)	3.8	29.3	0.3%	4.8	44.8	0.3%
Alcoholic beverages(J)	11.0		0.8%		78.7	0.7%
Alcoholic beverages (J)	11.0	81.6	0.8%	11.7	78.7	0.7%
Sauces, condiments and spices (K)	**40.7**		**3.0%**	**60.6**		**3.8%**
Sugar (K1)	8.2	42.1	0.6%	26.4	154.6	1.7%
Salt (K2)	2.8	3.9	0.2%	0	0.1	0.0%
Soy sauce (K3)	10.4	69.3	0.8%	9.5	63.1	0.6%
Other spice (K4)	19.3	94.2	1.4%	24.7	72.2	1.6%
Miscellaneous foods (L)	**34.3**		**2.5%**	**79.1**		**5.0%**
Instant noodles (L1)	6.1	37.8	0.4%	28.8	177.2	1.8%
Sandwiches, hamburger (L2)	3.9	21.1	0.3%	9.8	53.1	0.6%
Steamed buns and meat dumplings (L3)	12.9	45.4	0.9%	30.0	104.6	1.9%
Soups (L4)	8.4	105.6	0.6%	3.9	47.3	0.2%
Others (L5)	2.9	22.3	0.2%	6.7	71.4	0.4%

1,963 samples, 19-64 years old. Food weight is coverted to that of "raw" and "as purchased" form; % indicates contribution to daily total; standard deviation, SD. Food Categories have been previously defined (13).

Among cereals, grains, tubers, and roots group, rice and its products were the leading energy contributors, offering 678 kcal for males (30.8%) and 397 kcal for females (15%). Wheat and flour products only supplied 97 kcal for males (4.4%) and 94 kcal for females (5.9%). As for oils and fats, vegetable oils was the major subgroup, 99 kcal for males (4.5%) and 112 kcal for females (7.0%). In poultry and meat, pork and its products constituted the major subgroup, 375 kcal for males (17%) and 237 kcal for females (15%); chicken and its products provided a smaller amount of energy, 44 kcal for males (2.0%) and 26 kcal for females (1.7%). Seafood supplied 76 kcal for men (3.5%) and 57 kcal for women (3.6%). In other protein-rich foods, soybeans and its products constituted the major portion for males, 74 kcal (3.4%). As for females, dairy products constituted the main part, 56 kcal (3.5%). As to the consumption of vegetables, the calorie provided by this food group appeared similar, 69 kcal for men (3.1%) and 70 kcal for women (4.4%). Fruits supplied 75 kcal (4.7%) in women, and supply 60 kcal (2.7%) in men. As to the miscellaneous foods, the percentages of energy they provided for both men and women were the same: 5%. Among them, instant noodles, steamed buns and meat dumplings are the notable varieties. Raw materials (especially that of fats, oils, and seasonings in these foods) used in these foods were not dissected and added back to the food groups.

The contribution of food groups to three macro-nutrients

Dietary protein

Male adults ingested 83 g of protein (15.5% of the total energy) and women 62 g (15.5% of the total energy) daily. Cereal, grains, tubers, and roots group was the primary protein source: males, 18 g (21.3%); females, 12 g (19.1%). What followed were meats (males 16 g, 19.9%; females 11 g, 17.5%), other protein foods (males 13 g, 16.3%; females 12 g, 18.8%), and seafood (males 11 g, 13.4%; females 9 g, 14.1%). Poultry ranked fifth for men, 7 g (8.5%) and sixth for women, 4 g (6.3%). On the contrary, vegetables were fifth for women, 6 g (9%) and sixth for men, 5 g (6.6%).

Table 3 showed that, if the foods were further subdivided, both men and women relied on pork and its products as the primary suppliers of proteins, males 14 g (17.5 %) and females 10 g (16.3%). Rice and rice products were the second (males 14 g, 16.6%; females 8 g, 13.0%), and soybeans and soybean products were the third contributor (males 7 g, 8.6%; females 5 g, 8.5%). The proteins provided by dairy products ranked fourth in women's (4 g, 5.6%) and tenth in men's daily diet (3 g, 3.3%). Table 3 lists the twenty leading items of major protein sources, which contributed more than 90 percent of protein to both males and females.

Adding the amounts of proteins derived from meats, fish, legumes, and eggs group and converting them into numbers of exchanges, reveals that males consumed 45 g of protein, equivalent to 6.4 exchanges, while females consumed 31g, equivalent to 4.5 exchanges of the meats, fish, legumes, and eggs group. As to the supply of dairy products, males consumed about 0.3 exchange and female's 0.4 exchange, given 8 g of protein is one exchange.

Table 3 Major contributors of protein in the Taiwanese diet for male and female adults: subcategorized into 12 main foods

Male					Female			
Rank	Subcategory Food	g	%	Cumulative %	Subcategory Food	g	%	cumulative %
1	Pork and pork products (D1)	14.5	17.5%	17.5%	Pork and pork products (D1)	10.0	16.3%	16.3%
2	Rice and rice products (A1)	13.7	16.6%	34.1%	Rice and rice products (A1)	8.0	13.0%	29.3%
3	Soybean and soybean products (F3)	7.1	8.6%	42.7%	Soybean and soybean products (F3)	5.2	8.5%	37.8%
4	Chicken and chicken products (C1)	6.0	7.2%	49.9%	Milk and milk products (F2)	3.5	5.6%	43.4%
5	Saltwater fish(fresh) (E2)	4.1	5.0%	54.9%	Chicken and chicken products (C1)	3.4	5.5%	48.9%
6	Eggs and egg products (F1)	3.6	4.4%	59.3%	Shellfish and shellfish products (E4)	3.4	5.5%	54.4%
7	Wheat and flour products(A2)	3.2	3.9%	63.2%	Wheat and flour products (A2)	3.1	5.1%	59.5%
8	Shellfish and shellfish products (E4)	3.1	3.8%	67.0%	Eggs and egg products (F1)	2.9	4.6%	64.1%
9	Freshwater fish(fresh) (E1)	2.8	3.4%	70.4%	Saltwater fish(fresh) (E2)	2.5	4.1%	68.2%
10	Milk and milk products (F2)	2.7	3.3%	73.7%	Dark-green and deep yellow vegetables (G1)	2.2	3.6%	71.8%
11	Other spice (K4)	2.6	3.2%	76.9%	Other spice (K4)	2.1	3.5%	75.3%
12	Dark-green and deep yellow vegetables (G1)	2.2	2.7%	79.6%	Freshwater fish(fresh) (E1)	1.8	2.8%	78.1%
13	Light-color vegetables (G2)	1.6	1.9%	81.5%	Light-color vegetables (G2)	1.4	2.3%	80.4%
14	Beef and beef products (D2)	1.5	1.8%	83.3%	Fresh fruits (H1)	1.1	1.8%	82.2%
15	Steamed buns and meat dumplings (L3)	1.5	1.7%	85.0%	Steamed buns and meat dumplings (L3)	1.1	1.8%	84.0%
16	Fish products and fish organ (E3)	1.1	1.3%	86.3%	Fish products and fish organ (E3)	1.0	1.7%	85.7%
17	Pastries, and cookies (I2)	0.9	1.1%	87.4%	Pastries, and cookies (I2)	0.9	1.5%	87.2%
18	Fresh fruits (H1)	0.9	1.1%	88.5%	Breads (I1)	0.8	1.3%	88.5%
19	Breads (I1)	0.9	1.0%	89.5%	Soy sauce (K3)	0.8	1.3%	89.8%
20	Instant noodles (L1)	0.8	1.0%	90.5%	Pickles (G8)	0.7	1.2%	91.0%

Data are from the Nutrition and Health Survey in Taiwan, NAHSIT, 1993-1996

Dietary fat

The daily intake level of dietary fat was 80 g (33.5% of the total energy) for males and 61 g (34.4% of the total energy) for females. Men and women relied on meats as their main contributors of dietary fat, 35 g (43.9%) for males and 21 g (35.1 %) for females. The second contributor was fats and oils, 15 g for males (18.8%) and 16 g for females (26.1%), which is equivalent to 3 exchanges. The third was other protein-rich foods, 9 g for males (11. 6%) and 8 g for females (12.8%). Miscellaneous foods were the fourth on the list (males, 5 g, 6.3%; females, 4 g, 5.9%).

Table 4 Major contributors of Lipid in the Taiwanese diet for male and female adults: subcategorized into 12 main foods

Male					Female			
Rank	Subcategory Food	g	%	Cumula tive %	Subcategory Food	g	%	cumula tive %
1	Pork and pork products (D1)	33.9	42.6%	42.6%	Pork and pork products (D1)	21.1	34.6%	34.6%
2	Vegetable oils (B1)	11	13.8%	56.4%	Vegetable oils (B1)	12.4	20.3%	54.9%
3	Soybean and soybean products (F3)	3.9	4.9%	61.3%	Soybean and soybean products (F3)	3.0	4.9%	59.8%
4	Animal fats (B2)	3	3.8%	65.1%	Animal fats (B2)	2.8	4.5%	64.3%
5	Eggs and egg products (F1)	3.0	3.7%	68.8%	Pastries, and cookies (I2)	2.5	4.1%	68.4%
6	Pastries, and cookies (I2)	2.6	3.2%	72.0%	Milk and milk products (F2)	2.4	4.0%	72.4%
7	Milk and milk products (F2)	2.4	3.0%	75.0%	Eggs and egg products (F1)	2.4	3.8%	76.2%
8	Instant noodles (L1)	2.1	2.6%	77.6%	Instant noodles (L1)	1.5	2.5%	78.7%
9	Rice and rice products (A1)	2.1	2.6%	80.2%	Wheat and flour products (A2)	1.4	2.3%	81.0%
10	Chicken and chicken products (C1)	2.1	2.6%	82.8%	Steamed buns and meat dumplings (L3)	1.3	2.2%	83.2%
11	Steamed buns and meat dumplings (L3)	1.8	2.3%	85.1%	Chicken and chicken products (C1)	1.3	2.1%	85.3%
12	Wheat and flour products (A2)	1.6	2.0%	87.1%	Rice and rice products (A1)	1.3	2.1%	87.4%
13	Saltwater fish(fresh) (E2)	1.5	1.8%	88.9%	Other spice (K4)	1.2	1.9%	89.3%
14	Other spice (K4)	1.4	1.8%	90.7%	Saltwater fish(fresh) (E2)	0.9	1.5%	90.8%
15	Nuts and nut products (B3)	1.0	1.2%	91.9%	Nuts and nut products (B3)	0.8	1.3%	92.1%

Data are from the Nutrition and Health Survey in Taiwan, NAHSIT, 1993-1996

If we subcategorize the foods, Table 4 showed that both men and women relied on pork and its products as the main suppliers of dietary fat, 34 g for males (42.6%) and 21 g for females (34.6%). What followed were vegetable oils (11 g, 13.8% for males; 12 g, 20.3% for females), and soybeans and soybean products (4 g, 4.9% for males; 3 g, 4.9% for females). The fourth was animal fats, 3 g for males (3.8%) and 3 g for females (4.5%). Table 4 lists the 15 leading food groups that contributed to dietary fat in men and women. Among them, the first 14 items provided more than 90 percent of the dietary fat.

Dietary carbohydrate

Male adults consumed 272 g of carbohydrates (50.8% of the total energy) and females 200 g (50.1% of the total energy) daily. Cereals, grains, tubers, and roots group was the primary source for both men (173 g, 63.6%) and women (111 g, 55.8%), followed by refreshments and snacks (36 g, 13.1% for males; 26 g, 13.1% for females); and fruits (14 g, 5.0% for males; 17 g, 8.7% for females) in that order.

If the foods were further subdivided (Table 5), rice and rice products subgroup was the major carbohydrate contributor: 151 g (55.4%) for men and 88 g (44.2%) for women. Wheat and flour products group was the next, 17 g (6.5%) for men and 17 g (8.6%) for women. Sugary crushed ice and sugary drinks group was the third for men (16 g, 5.70%) and the fifth for women (8 g, 3.8%). Fresh fruit group was the fourth for men (13 g, 4.7%) and the third for women (16 g, 8.1%). Another indispensable source was cakes, cookies and pastries group, which ranked the fifth for men (9 g, 3.3%) and the fourth for women (10 g, 5.1%). A list is given in Table 5 of the 15 leading suppliers of dietary carbohydrates, which provided over 90 percent of carbohydrates.

The amount of carbohydrate derived from cereals, grains, tubers, and roots group; breads, pastries, and cookies group; instant noodles, sandwiches, and hamburgers group; steamed bun and meat dumpling group was converted into numbers of exchanges by the Food Exchange List. It shows that 198 g carbohydrate consumed by men was equivalent to 13.2 exchange and 135 g carbohydrate consumed by women was equivalent to 9 exchanges. Calculating from the intakes of simple sugar from candies, sweetened crushed ice and sugary drinks, processed juices and seasoning sugar, males ingested 25 g and females 17 g of simple sugar.

As to the intake of fruits, given 15 g of carbohydrates from fruit were one exchange, then males ingested 0.9 exchanges and females 1.2 exchanges.

Table 5 Major contributors of Carbohydrate in the Taiwanese diet for male and female adults: subcategorized into 12 main foods

Male					Female			
Rank	Subcategory Food	g	%	Cumulative %	Subcategory Food	g	%	cumulative %
1	Rice and rice products (A1)	150.8	55.4%	55.4%	Rice and rice products (A1)	88.2	44.2%	44.2%
2	Wheat and flour products (A2)	17.6	6.5%	61.9%	Wheat and flour products (A2)	17.2	8.6%	52.8%
3	Sweetened crushed ice and sugary drinks (I4)	15.6	5.7%	67.6%	Fresh fruits (H1)	16.1	8.1%	60.9%
4	Fresh fruits (H1)	12.9	4.7%	72.3%	Pastries, and cookies (I2)	10.2	5.1%	66.0%
5	Pastries, and cookies (I2)	9.1	3.3%	75.6%	Sweetened crushed ice and sugary drinks (I4)	7.7	3.8%	69.8%
6	Breads (I1)	5.7	2.1%	77.7%	Milk and milk products (F2)	7.3	3.6%	73.4%
7	Milk and milk products (F2)	5.6	2.1%	79.8%	Sugar (K1)	6.7	3.3%	76.7%
8	Instant noodles (L1)	4.5	1.7%	81.5%	Breads (I1)	5.5	2.7%	79.4%
9	Sugar (K1)	4.2	1.6%	83.1%	Starchy roots and stems (A3)	4.8	2.4%	81.8%
10	Other spice (K4)	4.1	1.5%	84.6%	Dark-green and deep yellow vegetables (G1)	3.6	1.8%	83.6%
11	Steamed buns and meat dumplings (L3)	4.0	1.5%	86.1%	Steamed buns and meat dumplings (L3)	3.4	1.7%	85.3%
12	Processed juices (I5)	3.8	1.4%	87.5%	Instant noodles (L1)	3.2	1.6%	86.9%
13	Dark-green and deep-yellow vegetables (G1)	3.8	1.4%	88.9%	Other spice (K4)	2.8	1.4%	88.3%
14	Starchy roots and stems (A3)	3.5	1.3%	90.2%	Light-color vegetables (G2)	2.5	1.3%	89.6%
15	Soybean and soybean products (F3)	3.3	1.2%	91.4%	Soybean and soybean products (F3)	2.5	1.2%	90.8%

Data are from the Nutrition and Health Survey in Taiwan, NAHSIT, 1993-1996

Discussion

The present analyses show that the daily amounts of food intake by the adult were 1,821 g for males and 1,373 g for females. Rice and rice products were the main carbohydrate foods consumed by Taiwanese. In terms of dietary fat intake, both males and females ingested 18 g of fats or oils group daily, most of which were added in the process of cooking. There was larger quantity of invisible fats ingested from meats and poultry and processed/purchased foods. It is necessary to pay attention to the consumption of the invisible fats, particularly those contained in the pork and pork products which were the major item in the meat groups.

Dark-green and deep-yellow vegetables were the primary vegetables consumed by Taiwanese men and women. Although both men and women consumed similar amounts of vegetables, the percentage of vegetables in women's diet was higher than that in men's. In addition, men consumed more of every kind of foods than women with the exception of fruits. Fruits were the second leading food group consumed by women in terms of food weight, indicating women's preference for fruits. There was also a men-women difference in alcohol consumption. Around 5% of the food weight in men came from alcohol. Whereas in women it was less than one percent.

Refreshments and snacks group was a major source of foods in terms of weight, primarily because of the consumption of sweetened crushed ice and sugary drinks.

Contributing foods of calories

Cereals, grains, tubers, and roots and meat groups were two primary calorie sources in both men and women. Refreshments and snacks group was the third energy providers for men and the fifth for women, revealing that refreshments and snacks contributed substantially as an energy source more so in men than in women.

In cereals, grains, tubers, and roots group, rice and rice products were the main calorie contributors. In the meat group, pork and its products were the major contributors. Refreshments and snacks were important providers of calories, constituting 8.4 % of men's and 9.1% of women's calorie intake, almost equal to what was provided by the fats and oils category. Sweetened crushed ice and sugary drinks were the major sources of snacks and refreshments for men. Pastries, and cookies group were next, whereas for women, Pastries, and cookies group were the major sources of refreshments and snacks, with sweetened crushed ice and sugary drinks next.

Miscellaneous foods provided 5% of energy for both men and women, with instant noodles, steamed buns, meat dumplings being the more common ones. If we dissected this group, the figure for the cereals, grains, tubers, and roots group and meat group would both increase slightly.

Food sources of three macro-nutrients

Protein and lipid

This Taiwanese diet provided 15.5% of total calories as protein, a slightly higher amount than that recommended by the Department of Health (DOH) (10 to 14%) (12). Men ingested 6.4 exchanges of meats, fish, legumes, or eggs and women 4.5 exchanges, which also exceeds the DOH's recommendation of 4 servings (12). Furthermore, the major contributors of proteins in this diet were cereals, grains, tubers, and roots, meats, other protein-rich foods, and seafood. In terms of finer groupings, both men and women rely on pork and pork products as their main protein providers, followed by rice and rice products, and soybeans and soybean products.

Dietary fat made up 33.5% of men's total caloric intake and 34.4% of women's, both were higher than the DOH's recommendation level of 20 to 30% (12). The main providers of the dietary fat were the meat group, followed by fats and oils, other protein-rich foods, and miscellaneous foods. In finer groupings, both men and women relied on pork and its products as the main fat providers, followed by vegetable oils, soybeans and soybean products, and animal fats.

Adding vegetable oils and animal fats used in cooking, intake approximated 3 exchanges of fats and oils, which is below the recommended 2-3 tablespoons (12). However, dietary fat has contributed 34% of dietary calorie in present-day Taiwan. Frequency of consuming processed/purchased foods has increased. The amount of cooking oil in these foods was not counted in the above computation. In addition, adults ingested relatively smaller amounts of carbohydrate and too much protein and fat with pork and pork products being the main contributors. Converting the consumption into numbers of exchanges reveals that on average, men consumed 2 exchanges and women 1.4 exchanges of pork and pork products daily. In order to lower the intake of proteins and fats, consuming lean pork or reducing pork consumption may be beneficial. Pragmatic consideration should be given to the Daily Dietary Guidelines for fats and oils group.

Men consumed 1.6 exchanges and women 1.2 exchanges of seafood, which was adequate. As to eggs, both men and women on average ate half an egg a day. Men ate about one exchange, women less than one exchange of legumes per day. In the provision of dairy products and its proteins, men consumed 0.3 exchange and women 0.4 exchange a day which was by far too low to achieve the calcium requirement.

Carbohydrate

Carbohydrates made up around 50% of the caloric intake in Taiwanese diet, which was obviously lower than the DOH's recommendation level of 58% to 68% (12). The contributors of the carbohydrates were mainly cereals, grains, tubers, and roots group; refreshments and snacks; and fruits in that order. With food groups further subdivided, we found that men depend on rice and its products as the major carbohydrate

suppliers, followed by wheat and flour products, sweetened crushed ice and sugary drinks, fresh fruits, pastries and cookies. The sweetened crushed ice and sugary drinks were the fifth providers of carbohydrates for women, after pastries and cookies. Men, on average, ingested 3.3 bowls and women 2.3 bowls of rice per day. This was below or on the lower brink of the DOH's recommendation level of 3 to 6 bowls per day (12).

An adequate 3 exchanges of vegetables were ingested daily by men and women. Men consumed about 0.9 exchange and women 1.2 exchanges of fruits per day, which was lower than the DOH's recommendation level of 2 servings (12). However, vitamin C intake level was adequate, given the current status of vegetable and fruit consumption (10). Increased consumption of vegetables and fruits as well as whole grains and cereals may be considered to increase fiber intake.

Males ingested 25 g and females 17 g of simple sugar daily. DOH recommends that simple sugar should be less than 10 percent of total energy intake (12), i.e., less than 22 g for males and less than 16 g for females. The authors therefore suggested that men and women should lessen their intake of simple sugar by avoiding sugary ice and drinks in particular.

According to Taiwan Daily Dietary Guidelines (12) of 12-24 exchanges of cereals, grains, tubers, or roots; 2-3 tablespoons of fats or oils; 4 exchanges of meats, fish, legumes, or eggs; 1-2 exchanges of dairy products; 3 exchanges of vegetables; and 2 exchanges of fruits; Taiwanese dietary pattern was adequate in vegetables; high in meats, fish, legumes, and eggs; but low in cereals, grains, tubers, and roots; fruits; and dairy groups. Dietary fat was above the 30% of calories as recommended by DOH. In addition, the pork and pork products group was the major contributor of both dietary protein and fat. Carbohydrate intake was low and it primarily came from the cereals, grains, tubers, and roots group; refreshment and snacks; and fruits in that order. Therefore, modification can be made to reduce the amounts and the fat content of the pork products consumed, to reduce refreshments and snacks with empty calorie, and to increase dairy products, vegetables, and fruits to achieve a more balanced diet for Taiwanese. In addition, pragmatic modification should be considered for the recommendation of 2-3 tablespoons of fats and oils per day, which is difficult to follow in practice.

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