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Nutritional Evaluation of Chinese Working Women in the City of Tainan, Taiwan

SHINICHIRO SHIMBO[1], CHAN-SEOK MOON[2], ZUO-WEN ZHANG[2], TAKAO WATANABE[3], YUE-LIANG LEON GUO[4], WEN-CHUAN MA[4], HARUO NAKATSUKA[5], CHEAU-JANE PENG[6] and MASAYUKI IKEDA[2,7]

[1]*Department of Food and Nutrition, Kyoto Women's University, Kyoto 605,* [2]*Department of Public Health, Kyoto University Faculty of Medicine, Kyoto 606-01,* [3]*Miyagi University of Education, Sendai 980,* [4]*Department of Environmental and Occupational Health, National Cheng Kung University Medical College, Tainan 70428, Taiwan, Republic of China,* [5]*Department of Environmental Sciences, Tohoku University School of Medicine, Sendai 980-77,* [6]*Department of Nutrition, National Cheng Kung University Medical Center, Tainan 70428, Taiwan, Republic of China, and* [7]*Kyoto Industrial Health Association, Kyoto 604*

SHIMBO, S., MOON, C.-S., ZHANG, Z.-W., WATANABE, T., GUO, Y.-L. L., MA, W.-C., NAKATSUKA, H., PENG, C.-J. and IKEDA, M. *Nutritional Evaluation of Chinese Working Women in the City of Tainan, Taiwan.* Tohoku J. Exp. Med., 1997, **181** (3), 339-352 —— Nutritional survey was conducted in 1994 in Tainan City, southern Taiwan. Total food duplicate samples were collected from 52 women volunteers. Clinical examinations, anthropometry, hematology and serum biochemistry were also conducted. The intakes of nutrients were estimated from the weights of food items in reference to the standard food composition tables for Taiwanese. On average, the participants took 1,973 kcal energy, 69 g protein, 73 g lipid and 269 g carbohydrate per day. Animal-based foods accounted for 49% and 36% of protein and lipid sources, respectively, but fish and shellfish contributed only 11% for protein and essentially nil for lipid. Lunch was the most substantial meal of the day. When classified by age (i.e., 22-29, 30-39 and 40-66 year-old groups), no age-related difference was detected among the three groups in all nutrients except for crude fiber. Comparison with recommended dietary allowance (RDA) for Taiwanese, the insufficiency ratios were more than 50% for minerals (i.e., Fe and Ca) and vitamins (except for vitamin C). Excess in the lipid energy ratio (>30%) was observed in 60% of the study population. In agreement with this high lipid intake, 17% of the participants had BMI of >25, and triglyceride levels were elevated (>150 mg/100 ml) in 27%. There was no anemic case despite the low Fe intake (14 mg/day). ———— Chinese women; lipid; nutrient intake; overweight; Tainan

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Address for reprints: Masayuki Ikeda. Present address; Kyoto Industrial Health Association, 67 Nishinokyo-Kitatsuboicho, Nakagyo-ku, Kyoto 604, Japan.

Taiwan is one of the most rapidly developing areas in the world, with remarkable economic growth in recent years. In the past, however, Taiwan also had been suffering from nutritional problems, as were many other areas in the world, such as low intakes of animal protein, iron and, to a lesser extent, calcium (Chen 1968; Hsu 1973; Huang et al. 1973,1983). For example, Huang (1974) stated in a review that there was substantial improvement in energy intake in 1972 (2,704 kcal/day) as compared with the level in 1950 (2,058 kcal/day), and Huang and Tung (1975) described that iron intake increased substantially from 8 mg/day in 1950 to 12 mg/day in 1970, which was followed by remarkable reduction in the prevalence of anemia among schoolchildren. According to Chen et al. (1974), hemoglobin concentration was below 10.5 g/100 ml in about a half of 3-5 year-old children, although the situation was much better among 5-12 year-old children. Similarly, Chiou et al. (1990) summarized that the prevalence of iron deficiency was about 34% among children in southern Taiwan, although two thirds of the cases were not anemic.

The present study was initiated to elucidate the current nutritional situation of urban people in southern Taiwan. Attentions were focussed to detect possible effects of rapid economic growth on nutritional health of the people, such as 1) disappearance of anemia in association of improved iron intake (Shimbo et al. 1996) on a favorable side, and 2) development of high lipid intake (Huang et al. 1983) and resulting obesity (Shimbo et al. 1996) on the other.

Materials and Methods

Study population and sample collection

The survey was conducted in November, 1994, in the city of Tainan (with about 0.7 million population) in southern Taiwan. Adult women were invited to join the study, and 52 women volunteered in practice. They were teaching staff, nurses, etc. in a large medical center. The absence of any specific disease was confirmed in a clinical interview, and also by hematological and serum biochemistry studies as will be discussed later. Women rather than men were selected because they were traditionally nonsmoking and nonhabitually drinking, and were expected to have better chance of offering total food duplicate samples (see below). The average age of the participants was 35.8±11.4 years as a mean±a standard deviation (s.d.), and distributed in a range of 22 to 66 years (Table 1).

Food duplicate collection, and health examination including anthropometry

The procedures of collecting 24-hr total food duplicate samples (Acheson et al. 1980) were as previously detailed (Shimbo et al. 1993, 1994); each food duplicate sample included three meals, snack, drinks and whatever the participant took (thus even fresh water if taken) in the same way and in the same amount as she consumed (e.g., salting, dipping in sauce, or use of ketchup). It should be noted that any special social occasion was waived and that each participant was remind-

TABLE 1. *Anthropometry of study participants*

Age (years)	Number of women	Height (H) (cm)	Weight (W) (kg)	BMI ($W/H^2 \times 10^4$)	Overweight cases (%)[a]
22-29	18	158.7±4.6	53.3±6.9	21.1±2.6	2 (11%)
30-39	22	158.0±5.1	52.4±6.3	21.0±2.3	2 (9%)
40-66	12	155.1±4.2	58.7±4.7	24.4±1.8	5 (42%)
Total[b]	52	157.6±4.9	54.2±6.7	21.8±2.7	9 (17%)
p		0.13[c]	0.02[c]	<0.01[c]	<0.05[d]

Values are mean±S.D.
[a]The ratio of subjects who had BMI of ≥25 (Fatimah et al. 1995).
[b]Mean±S.D. ages for total subjects are 33.2±6.9 years.
[c]p-Values are from the difference among the three age groups as examined by ANOVA.
[d]p-Value by chi-squares test.

ed to prepare ordinary meals. On the next morning of the food duplicate collection, the participant delivered her food duplicate sample, offered peripheral blood, and had physical examination including height and weight measurements.

Nutritional evaluation and other examinations

The protocol of nutritional analysis was previously detailed (Shimbo et al. 1993, 1994, 1996). In short, each food item was coded in accordance with food composition tables for Taiwanese (Department of Health 1991; to be abbreviated as Food Composition Tables). Nutrient intakes in three meals and snack, and also for an entire day were calculated for each woman from the code numbers and the weight records, taking advantage of the food composition tables. The tables consist of 453 food items (both raw and cooked), which in practice could cover essentially all food items encountered in the present survey.

Nutritional evaluation on a group basis was made in reference to recommended daily dietary allowances (RDA in short) for Taiwanese with middle grade physical burden (Department of Health 1993). RDA values for adult women are cited in Table 2. In case of lipid, the value of 30% as the ratio of lipid-based energy over total energy (the lipid energy ratio) was taken as a upper limit of the recommended intake (Department of Health 1993). For the evaluation of individual cases, 80-120% RDA was tentatively considered as an acceptable range, taking day-to-day variation in nutrient intake into considerations (Shimbo et al. 1996).

Clinical hematology tests and serum biochemistry tests were conducted by the conventional methods. Blood samples were drawn 2 to 3 hr after breakfast. Body Mass Index (or BMI) was calculated as weight (in kg)/[height (in meter)]^2.

Statistical analysis

A normal distribution was assumed for most nutrients, and the distribution was expressed in terms of mean and S.D. Chisquares test and ANOVA were employed to detect possible significant difference in distribution or among means. When coefficients of variation were large (e.g., >100%) and a normal distribution could hardly be assumed, possible significant differences in the distributions were examined by median test (Tsuji 1981). Multiple regression analysis (with the step-up procedure) was also employed when necessary.

RESULTS

Anthropometry and physical examination

The results of anthropometry is summarized in Table 1. Whereas there was no significant ($p>0.10$) difference in height among the various age groups, the 40-66 year-old group was significantly heavier ($p<0.05$) than other two groups so that both BMI and the prevalence of the over-weighted cases (i.e., those with >25 BMI; Fatimah et al. 1995) were also the largest ($p<0.01$) in this eldest group.

TABLE 2. *Recommended dietary allowances for Taiwanese women by age range*

Energy & nutrient	(unit/day)	Age range (years)					
		16-19	20-24	25-34	35-54	55-69	≥70
Energy	(kcal)	2,100	2,000	1,900	1,900	1,850	1,800
Protein	(g)	55	55	55	55	55	55
Minerals							
Calcium	(mg)	700	700	600	600	600	600
Phosphorus	(mg)	700	700	600	600	600	600
Iron	(mg)	15	15	15	15	10	10
Iodine	(μg)	105	100	95	90	95	90
Vitamins							
Vitamin A	(IU)	4,200	4,200	4,200	4,200	4,200	4,200
Vitamin B_1	(mg)	1.1	1.0	1.0	1.0	0.9	0.9
Vitamin B_2	(mg)	1.2	1.1	1.0	1.0	1.0	1.0
Vitamin B_6	(mg)	1.4	1.4	1.4	1.4	1.4	1.4
Vitamin B_{12}	(μg)	2.0	2.0	2.0	2.0	2.0	2.0
Folic acid	(μg)	200	200	200	200	200	200
Niacin	(mg)	13.0	14.0	14.0	13.0	12.0	12.0
Vitamin C	(mg)	55	60	60	60	60	60
Vitamin D	(μg)	10	5	5	5	5	5
Vitamin E	(α-TE[a] μg)	10	10	10	10	10	10

In addition, the ratio of energy from lipid over that of all sources should not exceed 30%. The table and the note are cited from Department of Health (1993).

[a] α-Tocopherol equivalency.

Hematological examination showed that none of the participants had reduced erythrocyte counts (criterion; <3.80 million cells/mm^3), hemoglobin concentration (<12.0 g/100 ml) or hematocrit value ($<35\%$). Leukocyte counts also stayed within a normal range (4,000–9,000 cells/mm^3) in all cases. In serum biochemistry, AST, ALT and γ-GTP stayed unchanged, and no reduction in pseudocholinesterase level was observed.

Of particular interest was the observation that those with elevated serum triglyceride (TG) levels (>150 mg/100 ml) were more prevalent ($p<0.01$ by chi-squares test) at higher ages (1, 6 and 7 cases in the 22–29, 30–39 and 40–66 year-old groups, respectively). Whereas those with elevated TG (>150 mg/100 ml) tended to have large (>25) BMI ($p<0.05$) among the 52 participants, the distribution of those with elevated TG together with large BMI however was not biased to higher ages ($p>0.10$). Multiple regression analysis taking total energy, lipid energy ratio, age and serum TG level as independent variables and BMI as a dependent variable showed that TG was the only significantly contributing independent variable ($R^2=0.185$), indicating that TG was the most influential determinant of BMI explaining however less than 20% of variation in BMI.

Daily nutrient intake

Table 3 summarizes the results of nutritional evaluation in terms of intakes of energy, major nutrients, minerals and vitamins as estimated in reference to the food composition tables. The statistical evaluation showed that there was no age-dependent difference in nutrient intake among the three age groups ($p>0.10$ by chi-squares test), with one exception of fiber intake (<0.01). The fiber here means crude fiber and carries less meaning from a viewpoint of nutritional science.

The estimated nutrient intake by each individual was compared with the RDA (Table 1) taking two assumptions that the physical burden of the participants were of middle grade and that the range of 80 to 120% RDA is acceptable. The comparison showed that the prevalence (%) of excess lipid intake and insufficient intakes of minerals (Ca and Fe) and vitamins (all but vitamin C) were rather high (i.e., more than 50%) (Table 4). Further comparison of the prevalence of excess or insufficient cases among different age groups showed that the distribution was essentially uniform among the age groups ($p>0.05$) except for vitamin B_1, of which younger groups tended to show higher prevalence of insufficient intake ($p<0.01$); the p-value of <0.01 was taken as a cut-off point in evaluation because the number of subjects was limited in some age groups. There was no age-dependency in excess ($>30\%$) lipid energy ratio ($p>0.10$).

Nutrient intake by three meals

In Table 5, intakes of nutrients are classified into three meals and snack. It should be added that there was no age-related difference in intakes of total foods, energy or cooked rice at the time of three meals or snack ($p>0.10$ as examined by

TABLE 3. *Nutrient intake by age group*

Energy & nutrient	(unit/day)	All	Age group (years)			p^a
			22–29	30–39	40–66	
No. of subjects		52	18	22	12	
Age (years)		35.8±11.4	26.5±2.0	33.4±3.3	52.4±11.4	
Energy	(kcal)	1,972.9±604.7	1,969.8±814.2	1,936.6±458.3	2,044.0±444.3	0.89
Protein	(g)	68.8±23.5	60.4±17.1	70.9±21.8	77.5±30.0	0.13
Lipid	(g)	73.0±32.0	77.1±42.7	71.8±25.5	69.3±21.5	0.80
Carbohydrate	(g)	269.0±91.8	267.5±117.6	261.7±64.2	286.0±88.4	0.77
Fiber[b]	(g)	4.6±2.5	3.3±1.1	4.6±1.8	6.6±3.2	<0.01
Minerals						
Culcium	(mg)	496.5±224.7	434.9±210.2	502.6±233.8	577.7±199.9	0.24
Phosphorus	(mg)	965.5±350.6	860.2±290.9	982.0±334.4	1,093.4±409.1	0.20
Iron	(mg)	13.9±6.2	14.8±8.2	12.8±4.0	14.6±5.7	0.52
Vitamins						
Vitamin A	(IU)	4,888.8±2,791.7	5,513.2±3,138.1	5,018.0±2,642.0	3,715.2±2,052.0	0.23
Vitamin B_1	(mg)	1.00±0.46	0.87±0.50	1.02±0.37	1.14±0.51	0.28
Vitamin B_2	(mg)	0.93±0.37	0.84±0.28	0.92±0.34	1.08±0.47	0.23
Niacin	(mg)	9.85±4.64	9.51±6.00	10.03±3.76	10.05±3.62	0.93
Vitamin C	(mg)	119.8±101.4	98.0±65.8	118.4±84.9	154.9±151.4	0.34

Values are mean±S.D.
[a] p-Values for the differences among the three age groups as examined by ANOVA are shown.
[b] Crude fiber.

TABLE 4. *Excess or insufficient intake of nutrients*

Energy & nutrient	Excess /Insufficiency	No. of cases (Ratio, %) by age (years)					
		20-24	25-34	35-54	55-66	p[a]	Total
No. of subjects		2	25	19	6		52
Energy	Excess[b]	2 (100)	3 (12)	6 (32)	2 (33)	0.03	13 (25)
Ibid.	Insufficient[c]	0 (0)	6 (24)	5 (26)	0 (0)	0.46	11 (21)
Protein	Insufficient	0 (0)	6 (24)	10 (53)	0 (0)	0.04	16 (31)
Lipid	Excess[d]	1 (50)	17 (68)	9 (47)	4 (67)	0.55	31 (60)
Calcium	Insufficient	1 (50)	20 (80)	12 (63)	1 (17)	0.03	36 (69)
Iron	Insufficient	2 (100)	17 (68)	12 (63)	1 (17)	0.08	32 (62)
Vitamin A	Insufficient	0 (0)	11 (44)	11 (58)	6 (100)	0.04	28 (54)
Vitamin B_1	Insufficdient	1 (50)	21 (84)	8 (42)	1 (17)	<0.01	31 (60)
Vitamin B_2	Insufficient	1 (50)	20 (80)	14 (74)	2 (33)	0.13	37 (71)
Niacin	Insufficient	2 (100)	23 (92)	13 (68)	5 (83)	0.20	43 (83)
Vitamin C	Insufficient	1 (50)	11 (44)	6 (32)	0 (0)	0.22	18 (35)

[a]p-Value as examined by chi-squares test.
[b]More than 120% RDA. For RDA, see Table 2.
[c]Less than 80% RDA.
[d]The lipid energy ratio is >30%.

ANOVA), when the participants were classified by age and comparison was made among the age groups (data not shown).

It is natural that the weight of three meals was significantly different for almost all nutrients. It is interesting to note that lunch (and not dinner) was the most substantial meal of the day when evaluated in terms of weight, and intakes of energy, three major nutrients, iron (although not calcium) and many vitamins. In addition, the participants took 145 g of cooked rice in lunch time, which accounted for more than a half of the total cooked rice of the day (252 g). It is also worthy of attention that the weight of snack was pretty heavy, especially as the sources of energy and carbohydrate intake, although it was light in lipid and protein.

The amount of food taken for snack (437 g as a mean) appeared to be more than that of breakfast (344 g) in terms of weight, but it was less in terms of energy intake (271 kcal for snack vs. 372 kcal for breakfast), although the difference was statistically insignificant ($p>0.10$) due to wide variations. It was expectable that little cooked rice was consumed in snack.

Relative weight of rice and other cereals in three meals and snack

Perusal of the food records suggested that the dependency of the participants on rice and wheat might vary depending on the three meals. For quantitative evaluation, the consumption of rice and wheat was evaluated in terms of energy, as the energy per unit weight of cereals varied depending on food item. It should

TABLE 5. *Nutrient intake in 24 hours, and by three meals and snack*

Energy & nutrient	(unit/day)	Breakfast	Lunch	Dinner	p^a	Snack	Whole day
Total weight	(g)	343.5±152.8	600.7±230.2	546.1±200.0	<0.01	437.2±420.9	1,927.5±530.6
Energy	(kcal)	372.2±218.4	761.0±366.7	568.3±248.0	<0.01	271.3±299.5	1,972.7±604.7
Protein	(g)	13.3±8.5	26.2±11.3	21.5±10.9	<0.01	7.9±11.3	68.8±23.5
Lipid	(g)	12.5±9.9	31.8±23.1	22.8±11.5	<0.01	5.9±8.4	73.0±32.0
Carbohydrate	(g)	52.3±33.9	95.0±48.0	71.1±41.9	<0.01	50.9±54.2	269.0±91.8
Fiber[b]	(g)	0.7±0.7	1.8±1.7	1.5±1.0	<0.01	0.6±1.0	4.6±2.5
Ash	(g)	2.6±1.4	4.4±2.4	4.0±2.2	<0.01	2.0±2.9	13.0±4.5
Minerals							
Calcium	(mg)	160.1±112.7	131.9±87.5	147.0±126.3	0.43	57.4±87.1	496.5±224.7
Phosphorus	(mg)	220.9±163.8	346.6±131.7	307.8±178.5	<0.01	90.2±141.8	965.5±350.6
Iron	(mg)	1.9±3.1	5.4±2.3	5.1±4.1	<0.01	1.4±2.3	13.9±6.2
Vitamins							
Vitamin A	(IU)	341.2±500.8	2,522.8±2,053.7	1,768.3±1,997.4	<0.01	256.4±653.5	4,888.8±2,791.7
Vitamin B_1	(mg)	0.15±0.12	0.40±0.27	0.32±0.24	<0.01	0.12±0.20	1.00±0.46
Vitamin B_2	(mg)	0.27±0.17	0.28±0.12	0.27±0.18	0.91	0.11±0.18	0.93±0.37
Niacin	(mg)	1.37±1.62	4.22±1.73	3.32±1.91	<0.01	0.94±1.78	9.85±4.64
Vitamin C	(mg)	5.8±20.2	46.0±69.9	52.6±52.2	<0.01	15.4±32.9	119.8±101.4

Values are mean±S.D.
[a]p-Values are for the differences among three meals (i.e., breakfast, lunch and dinner) as examined by ANOVA.
[b]Crude fiber.

TABLE 6. *Energy intake via rice and wheat, by three meals and snack, and by age group*

Meal or snack	Energy from	All	Age group (years) 22–29	30–39	40–66	p^a
No. of subjects		52	18	22	12	
Breakfast	Rice[b]	21 : 0 (0–389)	30 : 0 (0–389)	11 : 0 (0–163)	25 : 0 (0–159)	0.03
	Wheat[c]	128 : 211 (0–419)	92 : 34 (0–312)	153 : 235 (0–419)	136 : 238 (0–269)	0.22
Lunch	Rice	228 : 327 (0–459)	240 : 323 (0–459)	227 : 335 (0–440)	211 : 331 (0–404)	0.82
	Wheat	59 : 0 (0–1,466)	84 : 0 (0–1,466)	36 : 0 (0–495)	63 : 0 (0–562)	0.10
Dinner	Rice	140 : 184 (0–413)	122 : 21 (0–394)	147 : 187 (0–413)	170 : 323 (0–397)	0.33
	Wheat	90 : 0 (0–526)	125 : 0 (0–526)	63 : 0 (0–490)	88 : 0 (0–455)	0.76
p^d	Rice	<0.01	<0.01	<0.01	0.01	
	Wheat	<0.01	0.06	<0.01	0.26	
Snack	Rice	13 : 0 (0–352)	22 : 0 (0–352)	6 : 0 (0–74)	14 : 0 (0–71)	0.03
	Wheat	54 : 0 (0–486)	57 : 0 (0–423)	71 : 0 (0–486)	20 : 0 (0–150)	0.50

Values (unit; kcal) are mean: median (minimum-maximum).
[a] p-Values as examined by median test when different age groups were compared.
[b] Energy in all rice-containing foods, e.g. boiled or steamed rice, rice cake, rice cookies, etc.
[c] Energy in all wheat-containing foods, e.g., noodle, steamed or baked bread, cookies, etc.
[d] p-Values as examined by median test when three meals were compared.

be added that the consumption of cereals other than rice and wheat was essentially nil. The results are summarized in Table 6, in which medians together with distribution ranges are also shown in addition to means because variations were generally wide to suggest that the assumption of normal distribution would not be applicable.

The evaluation of the results (Table 6) in terms of means and medians appeared to suggest that, although individual variation in food habits should be remarkable as large distribution ranges suggest, the major source of the energy was wheat in case of breakfast, whereas it was rice for lunch and dinner, probably indicating a substantial difference in cereals as the energy sources among the three meals. The observation was reproducible independent of different age groups ($p > 0.05$ for difference among age groups) with one exception of rice intake in breakfast ($p < 0.05$ to suggest that the 30-39 year-old group took less rice than other two age groups). Consumption of rice and wheat (especially rice) in snack was small regardless of different ages.

Major sources of protein and lipid

In order to examine the sources of protein and lipid in foods, all food items were classified in terms of animal or plant origin. The animal-based foods were further classified into land-based foods (i.e, animal meats, eggs and milk including dairy products) and fresh/sea water-based foods (i.e., fish and shellfish). The accounts of animal- or plant-originated foodstuffs as protein and lipid sources thus calculated are summarized in Table 7. It is evident from the table that substantial portions of protein (49%) and lipid (36%) are of animal origin and that fish/shellfish play only a very minor role as protein source and essentially nil as lipid source.

Discussion

The present study on 52 women (mostly at middle ages) in Tainan, Taiwan, made it clear that the subjects took 1,973 kcal energy (36% from lipid), 69 g protein, 73 g lipid and 269 g carbohydrate per day. When evaluated in comparison with RDA for Taiwanese (Department of Health 1993), the ratios of insufficient intake cases were more than 50% for minerals (i.e., Fe and Ca) and

Table 7. *Protein and lipid sources*

Food category (Unit: g/day)	Protein	Lipid
Animals [(A)+(B)]	34.1±20.2 (48.6%)	26.9±17.5 (35.8%)
(A) Meats, eggs and milk	26.7±16.2 (37.9%)	25.9±17.1 (34.4%)
(B) Fish and shellfish	7.4±10.1 (10.7%)	0.9±1.7 (0.0%)
Plants	34.7±16.8 (51.4%)	46.2±26.6 (64.2%)

Values are mean±s.d. (% contribution in total sources) of 52 cases.

TABLE 8. *Intake of major nutrients and minerals, as reported in literature*

Reference	Daily intake[a]						Remarks
	Energy	Protein	Lipid	CH.[b]	Ca	Fe	
(Unit/day)	(kcal)	(g)	(g)	(g)	(mg)	(mg)	
The present study	1,973	69	73 (33%)[c]	269	497	13.9	52 working adult women
Huang et al. (1973)	2,001	70	64 (29%)	286	398	11.9	393 people in 50 households in a district in Taipei
Huang et al. (1983)	2,115	67	74 (32%)	298	440	13.9	3,163 people of various ages and both sexes, whole island
Chiang and Huang (1986)	1,766	79	81 (41%)	186	496	13.5	39 medical students (girls)
	1,986	75	93 (42%)	211	582	14.3	14 medical studients (boys)
Chiang and Huang (1987)	2,290						42 medical students (girls)
	3,117						24 medical students (boys)
Pan et al. (1991a, b)	2,556	82	92 (32%)	349	522	16.7	Both sexes combined

[a]Methods used are various.
[b]Carbohydrate.
[c]The value in parenthesis is the lipid energy ratio (%). For definition, see the Materials and Methods section.

vitamins (except for vitamin C). These evaluations are based on the assumption that the physical burden of daily life is of middle grade. Thus, additional considerations might be necessary when the conclusion is extended to other populations, e.g, those with heavier physical burden, especially in cases of Ca, vitamin B_1 and vitamin B_2 (although not in the cases of Fe and vitamin A), because difference in physical load as well as body size (such as height) will affect the RDA for these nutrients (Ministry of Health and Welfare 1994).

The major findings in available literature on nutritional survey among Taiwanese are summarized in Table 8. The study conditions are not the same among the surveys. For example, many authors (Huang et al. 1973, 1983; Chiang and Huang 1986, 1987; Pan et al. 1991a, b) employed the food weight record method, whereas the present study used the food duplicate method because the comparison of the food composition table-based estimation with results of instrumental analysis is within the scope of the study (Moon et al. 1996) as to be discussed later. Furthermore, Chiang and Huang (1986, 1987) studied medical students who were apparently younger than the present study population. The values by Huang et al. (1983) and Pan et al. (1991a, b) are for both men and women in combination. As men take more foods than women [e.g., energy (Chiang and Huang 1987)], the present values for working adult women are in general agreement with the reported values although the values for protein and lipid tended to be lower and that for carbohydrate higher than previously reported.

One of the points of interest is high lipid intake. The average lipid energy ratio was about 33%, suggesting that more than a half of the study subjects took in excess of the RDA (<30%; Department of Health 1993). Such was in agreement with the results of foregoing studies in 1980s and 1990s (Huang et al. 1983; Chiang and Huang 1986, 1987; Pan et al. 1991a, b) although the ratio was reported to be lower in 1950-1970, i.e., 12% in 1950 and 23% in 1972 (Huang 1974). The ratio was already as high as 32% in 1980-1981 (Huang et al. 1983). Experiences show that a plenty of oil is used in frying dishes and in making desserts in traditional Chinese cooking. Medium lean meat is more welcomed than white meat or lean meat. In addition, food served as deep-fried becomes more and more popular in Taiwan regardless of Western or Chinese style foods.

Of particular interest is relatively heavy weight of lunch among the three meals. It was made clear that people in Japan (Yamada et al. 1996) and Korea (Moon et al. 1996) take dinner as the most substantial meal. In contrast, lunch is the heaviest for the subjects in the present study, which is in accordance with the observation among Malay women in Kuala Lumpur, Malaysia (Shimbo et al. 1996). Several possibilities may be hypothesized. One possibility is that tropical climates such as those in Tainan and Kuala Lumpur make people more comfortable to take heavy lunch and relatively light dinner, so that heavy lunch is just a widespread social custom. Alternatively, both Tainan and Kuala Lumpur study participants were working women (i.e., women who work out of their homes) and they may simply have more time to eat for lunch than for dinner. If the latter is the case, heavy lunch may be limited to working women and not a general custom of the community. Further study is apparently necessary for confirmation. In this connection, experience shows that people in Taiwan take lots of snacks high in starch, such as mung-bean soup, red-bean soup and tapioca soup which are usually sweetened. Sweetened tea is also a favored drink.

A discrepancy is noted between the high prevalence of insufficient iron intake (Table 4) and absence of anemia cases (Table 1). Although no further analysis such as determination of ferritin in serum was made, none of the 52 women had low hemoglobin concentration or reduced erythrocyte counts. RDA for iron for menstruating women is set at 15 mg/day in Taiwan (Table 2), whereas it is 12 mg/day for counterpart Japanese women (Ministry of Health and Welfare 1991, 1994) whose body size is similar to Taiwanese. Bearing in mind that 15 mg Fe/day is also the RDA for U.S. menstruating women (National Research Council Subcommittee 1989) who are substantially larger in body size (standard; 163 cm in height and 63 kg in weight) than Taiwanese women (157.6 cm in height and 54.2 kg in weight; Table 1), it might be the case that the Taiwanese RDA is somewhat too demanding. When Japanese RDA (12 mg/day) is applied, the ratio of sufficient Fe intake (i.e., 80% of Japanese RDA or ≥10 mg/day) goes up to 75%, offering a good reason for the absence of anemia.

It is also possible that the food composition table-based estimate might be different from true intake. Recently, our group (Moon et al. 1996) compared the estimated values with the measured values for Fe intake in 232 Japanese women. In short, the estimates were obtained by the food duplicate method as in the present study, taking advantage of the food composition tables for Japanese foods (Resources Council 1982). The homogenate of each duplicate sample was wet-ashed and analyzed for Fe by inductively coupled plasma atomic emission spectrometry. The comparison showed that the two values did not agree with each other although there was a significant correlation between them (Moon et al. 1996). A study is currently in progress in this group to clarify if such is also the case for Taiwanese foods.

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