Tohoku J. Exp. Med., 1998, **184**, 189-205

Total Food Duplicate Study on Nutrient Intake of Working Women in Manila, the Philippines

HARUO NAKATSUKA, ZUO-WEN ZHANG,[1] MARILYN G. AGETANO,[2] RONALD D. SUBIDA,[3] NAOKO INOUGUCHI, TAKAO WATANABE,[4] SHINICHIRO SHIMBO,[5] KAE HIGASHIKAWA[6] and MASAYUKI IKEDA[6]

Miyagi University, Taiwa-cho 981-3298, [1]Department of Public Health, Kyoto University Faculty of Medicine, Kyoto 606-8501, [2]Department of Nutrition and [3]Department of Environmental and Occupational Health, College of Public Health, University of the Philippines, Manila, the Philippines, [4]Miyagi University of Education, Sendai 980-0845, [5]Department of Food and Nutrition, Kyoto Women's University, Kyoto 605-8501, and [6]Kyoto Industrial Health Association, Kyoto 604-8472

NAKATSUKA, H., ZHANG, Z.-W., AGETANO, M.G., SUBIDA, R.D., INOUGUCHI, N., WATANABE, T., SHIMBO, S., HIGASHIKAWA, K. and IKEDA, M. *Total Food Duplicate Study on Nutrient Intake of Working Women in Manila, the Philippines.* Tohoku J. Exp. Med., 1998, **184** (3), 189-205 —— Intakes of various nutrients by working women in Manila, the Philippines, was surveyed by the total food duplicate method, with foci to elucidate relative weight of three meals and snack in addition to quantitative evaluation of nutrient intakes. In practice, 45 women (average age; 37.2 years) volunteered, who were all nonsmokers and nonhabitual drinkers, and mostly married. In parallel, hematology, serum biochemistry, anthropometry and clinical examinations were conducted. On average, the women took 1787 kcal energy, 57 g protein, and 54 g lipid daily. Comparison with the Recommended Dietary Allowances (RDA) for Filipinos showed that intakes of energy and major nutrients were adequate, whereas that of minerals (e.g., 15 mg Fe/day vs. 26 mg Fe/day as RDA) and vitamins (e.g., 0.65 mg vitamin B_1/day vs. 1 mg/day as RDA) were generally insufficient. Prevalence of anemia was however rather low with an average hemoglobin concentration of 12.9 g/100 ml blood. Rice was the staple source of energy for daily life, and beef rather than fish and shellfish was the leading source of protein. Lunch was the richest meal of a day (with the largest intake of energy, protein and lipid), and snacks rather than dinner appeared to be next substantial. ———— Anemia; Manila; nutrient intake; rice; women

Received December 3, 1997; revision accepted for publication February 4, 1998.

Address for reprints: Professor M. Ikeda, Kyoto Industrial Health Association, 67 Nishinokyo-Kitatsuboicho, Nakagyo-ku, Kyoto 604-8472, Japan.

Poor nutrition together with infectious diseases are two most hazardous environmental factors to disturb sound development of children (Steckel 1983; Guzman et al. 1994; Adair and Guilkey 1997). Thus, there is no need to stress that adequate nutrition is the basis for health of people. This study group has been investigating the nutritional status of people, especially that of adult working women, in various areas in Asia (Shimbo et al. 1993, 1994, 1996a, b, 1997a, b; Yamada et al. 1996; Moon et al. 1997; Zhang et al. 1997a), and found that insufficient intakes of calcium and iron are common problems among the women populations studied both in Japan and in other areas in Asia. Vitamin B_1 intake was also often in short especially among those who depended on rice for daily energy.

In the present article, we report on the current nutritional status of working women in Manila, the Philippines. In the Philippines, national nutritional surveys have been conducted once every few years (the latest and the fourth one in 1993: Kuizon et al. 1995; Velandria et al. 1995; Villavieja et al. 1995a, b). As the national survey gives the overview of the nutrient intake of the people in the Philippines, efforts are concentrated in this report to highlight the food customs among working women in Manila, such as relative weight of three meals and the role of snack as the occasion of nutrient intake.

Materials and Methods

Food duplicate and blood sample donors

This survey was conducted in June, 1997, in Manila, the Philippines, on the day when there were no social events either on community (e.g., festivals) or on personal levels (e.g., birthday). Invitation was extended to apparently healthy adult women serving in teaching, research or clerical positions of a large medical complex to participate in the study; only nonsmokers and nonhabitual drinkers were invited. In an orientation meeting, the attendants were informed of the study purpose and asked 1. to have a clinical interview on current health condition, past history of any diseases, and social habits (i.e., smoking and drinking), 2. to have a health examination including blood sampling from cubital vein (at 08 : 30 to noon), and 3. to offer 24-hour duplicate of food (Acheson et al. 1980) together with a menu record. In practice, 45 volunteering women were accepted.

Health examination

Health examination consisted of anthropometry, blood pressure measurement, and sampling of blood and spot urine. Sera were separated on-site. Clinical hematology (RBC, WBC and hemoglobin [Hb] concentration) and serum biochemistry tests (AST [EC 2.6.1.1], ALT [EC 2.6.1.2], γ-GTP [EC 2.3.2.1], ALP [EC 3.1.3.1], LDH [EC 1.1.1.27], LAP [EC 3.4.1.1], cholinesterase [EC 3.1.1.8], total protein, albumin, A/G ratio, total cholesterol, triglyceride, creatinine, BUN, uric acid) were conducted with Sismex NE-7000 (Toa Medical Electronics, Tokyo) and Hitachi 7350 autoanalyzer (Hitachi, Tokyo) in a clinical laboratory in Japan, and urinalysis was by test tape 'Uro-paper' (Eiken Chemicals, Tokyo). In addition, Hepatitis B virus (HBV)surface antigen (HBsAg), HBV core antibody (anti-HBc), HBV surface antibody (anti-HBs) and hepatitis C virus $antibody_2$ (anti-HCV_2) were assayed in Japan utilizing commercial RIA or EIA kits (Abbott-Dianabott, Tokyo).

Body weight was measured as clothed and shoes off, and the measure was corrected for the weight of the clothes by subtracting 1 kg. A body mass index (BMI) was calculated as $\{\text{weight (kg)}/[\text{height (cm)}]^2 \times 10^4\}$. A woman was considered over-weighted when her BMI was 25 or greater (James et al. 1989); the value of 25 has been used also in Malaysia, a neighboring country in south-east Asia (Fatimah et al. 1995).

Food duplicate collection

Protocol and procedures for collection of 24-hour total food duplicates (Acheson et al. 1980) as well as menu records were previously described in detail (Shimbo et al. 1996a, b; Moon et al. 1997; Qu et al. 1997; Zhang et al. 1997a). It should be stressed that donors were carefully instructed to prepare and collect everyday foods and no special dishes.

Nutritional evaluation

Procedures of nutritional evaluation were also previously described (Shimbo et al. 1996a, b; Moon et al. 1997; Qu et al. 1997; Zhang et al. 1997a). In practice, food items in the food duplicate sample were manually isolated and individual weight was recorded. Each food item was then coded by an experienced Filipina nutritionist in the study group. Food Composition Tables for Filipino Foods (Food and Nutrition Research Institute 1990, 1997; Tanchoco et al. 1994; Guzman et al. 1995; Florentino et al. 1996a) were employed for coding and nutrient intake calculation.

Evaluation was carried out in comparison with the Recommended Dietary Allowances (RDA) for Filipinos (RDA Committee 1989), of which the values for adult healthy women with daily moderate physical exercise are summarized in Table 1; 80-120% RDA was tentatively considered as acceptable, taking day-by-day variation in nutrient intake into considerations (Shimbo et al. 1996a, b; Moon et al. 1997; Qu et al. 1997; Zhang et al. 1997a). For lipid intake, the value of 30% as the ratio of lipid-based energy over total energy (originally recommended for Americans [Committee on Diet and Health 1989]) was tentatively taken because no recommendation is available in the RDA list for Filipinos (RDA Committee 1989).

Statistical analysis

A normal distribution was for most nutrients, age and others, and an arithme-

TABLE 1. *Recommended dietary allowances for women in the Philippines by age range*

Nutrient (Unit/day)	Age range (years)					
	16–19	20–39	40–49	50–59	60–69	≥70
Energy (kcal)	2020	1900	1800	1710	1540	1390
Protein (g)	56	52	52	52	52	52
Minerals						
Calcium (mg)	700	500	500	500	500	500
Irom (mg)	25[a]	26[a]	26[a]	11	11	11
Vitamins						
Vitamin A (μg RE[b])	450	450	450	450	450	450
Vitamin B_1 (mg)	1.0	1.0	0.9	0.8	0.8	0.7
Vitamin B_2 (mg)	1.0	1.0	0.9	0.8	0.8	0.7
Niacin (mg)	19	18	17	16	15	13
Vitamin C (mg)	80	70	70	70	70	70
Folate (μg)	150	150	150	150	150	150

Cited from RDA Committee (1989); RDAs are given be sex and age. Moderate physical activities are assumed.

[a]According to the RDA Committee (1989), these recommended dietary allowances cannot be met by the usual diet, and thus, supplementation is recommended.

[b]In retinol equivalency.

tic mean (AM) and an arithmetic standard deviation (ASD) were taken as representative parameters of the distribution. For evaluation of enzymic parameters in serum biochemistry, a log-normal (rather than normal) distribution was considered and a geometric mean (GM) and a geometric standard deviation (GSD) were calculated. The log-normal assumption was applied also for the distribution of mineral and vitamin intakes in addition to the normal one, because ASD often exceeded AM. One-way analysis of variance (ANOVA) and multiple comparison test (Scheffe) were employed to detect possible significant difference among (or between) means (after logarithmic conversion, when necessary). Chi-square test (with Yates' correction when the number of cases was ≤5) was also used for the detection of the difference in prevalence. Regression analysis was employed to detect possible correlation between two parameters.

RESULTS

Daily nutrient intake

The medical interview showed that the volunteers were all nonsmokers and nonhabitual drinkers, and mostly married. They were at the age of 37.2±10.0 years (as AM±ASD); 20 %, 40% and 40% of the women (i.e., 9, 18 and 18 women) were in a range of 29 years of age or younger, 30 to 39 years and 40 years or older, respectively.

Total food intake and intakes of major nutrients are summarized in Table 2.

ANOVA showed that there was no significant ($p>0.05$) difference in intakes of any nutrient items among different age groups. Thus, the women studied on an average took 1787 kcal, including 57 g protein and 54 g lipid, daily; carbohydrate accounted for about 60% of the total energy source, and lipid contributed 27%.

Regarding the intakes of minerals and vitamins, ASD was sometimes 50% or more of AM, indicating that the inter-individual (and most probably day-to-day) variations were wide (Table 2). Thus GMs were also given in the table. As AM, the women took 502 mg calcium and 15 mg iron, and 500 μg vitamin A, 0.65 mg vitamin B_1, 0.79 mg vitamin B_2, 22 mg niacin and 28 mg vitamin C per day. As the Food Composition Tables (Food and Nutrition Research Institute 1997) does not give information on sodium and potassium contents in foods, no estimation was possible by the present method for the intakes of these electrolytes.

The intakes of major and minor nutrients were evaluated in comparison with RDA for each nutrient, taking 80–120% RDA as acceptable (Table 3). The intake of energy, protein and lipid appeared to be generally adequate. In contrast, inadequate cases were prevalent for minerals and vitamins; those with inadequate intake accounted for more than 50% in most items. The prevalence

TABLE 2. *Nutrient intake by age group*

Nutrient (Unit/day)	Age group (years)			
	All	29 or less	30–39	40 or more
No. of subjects	45	9	18	17
Age (years)	37.2±10.0	24.4±2.2	33.9±3.1	46.8±7.1
Energy (kcal)	1787±604	1608±512	1916±783	1746±415
Protein (g)	57.0±20.5	49.2±16.1	53.7±17.5	64.3±23.7
Lipid (g)	54.0±27.1	52.5±26.5	60.5±34.3	48.1±17.5
Carbohydrate (g)	273±107	237±104	299±139	265±63
Fiber[a] (g)	4.0±4.9	2.7±2.0	3.8±2.4	4.9±7.3
Minerals				
Calcium (mg)	502±390	292±142	590±357	519±474
Phosphorus (mg)	747±335	539±188	783±370	815±329
Iron (mg)	15.0±9.9	15.3±9.6	13.0±5.0	16.8±13.3
Vitamins				
Vitamin A (μg RE[b])	500±770	266±122	414±394	702±1137
Vitamin B_1 (mg)	0.65±0.30	0.49±0.24	0.73±0.35	0.65±0.25
Vitamin B_2 (mg)	0.79±0.44	0.60±0.22	0.86±0.44	0.82±0.52
Niacin (mg)	22.0±32.3	11.7±5.9	20.0±25.1	29.1±44.0
Vitamin C (mg)	28.4±24.3	19.5±19.4	29.2±31.2	31.9±18.1

Values are AM±ASD. No significant ($p>0.05$) difference was detected among the three age groups as examined by ANOVA.

[a]Crude fiber.

[b]In retinol equivalency.

TABLE 3. *Excess or insufficient intake of nutrients*

Nutrient	Excess/Insufficiency	Number of cases[a]	Ratio (%)
Energy	Excess[b]	6	13
Energy	Insufficient[c]	7	16
Protein	Insufficient	5	11
Lipid	Excess[d]	10	22
Calcium	Insufficient	22	49
Iron	Insufficient	33	73
Vitamin A[e]	Insufficient	24	53
Vitamin B_1	Insufficient	29	64
Vitamin B_2	Insufficient	24	53
Niacin	Insufficient	21	47
Vitamin C	Insufficient	24	53

[a]Out of 45 cases.
[b]More than 120% RDA. For RDA, see Table 1.
[c]Less than 80% RDA.
[d]The ratio of lipid over total nutrients in terms of energy is >30%.
[e]In retinol equivalency.

of insufficient cases was highest for iron (73%) and then for vitamin B_1 (64%).

Energy and nutrient intake by three meals and snack

Intakes of energy, and major and minor nutrients of the day were classified into three meals and snack to examine relative importance of each meal in nutrition (Table 4). A preliminary analysis by age group showed that there was no significant ($p>0.05$ by ANOVA) difference among the three age groups in total food (by weight) or energy intake (by kcal) at three meals or snack. Unless otherwise specified, threfore, further analyses in nutrient intakes were carried out with the 45 women as a group, assuming that age-related differences were insignificant.

No significant ($p>0.05$ by ANOVA) difference was observed in the weight of three meals (and also in the four occasions of three meals and snacks) as the sources of minerals and vitamins in general, except that vitamin A and niacin intakes were low in breakfast and that vitamin C intake was higher in dinner (and to a lesser extent in lunch) than in breakfast or snack.

In contrast, variations were significant ($p<0.01$ by ANOVA) in the weight of three meals and also snack as the sources of major nutrients (Table 4). Thus, the women took significantly more energy, protein and lipid at lunch than at other meals or snack ($p<0.01$ by ANOVA and $p<0.01$ to 0.10 by multiple comparison test depending on the pairs), indicating that lunch was the most substantial meal of the day. It was also worth noting that the largest amount of carbohydrate was taken in snacks ($p<0.05$ by ANOVA).

TABLE 4. *Nutrient intake in a whole day, and by three meals and snack*

Nutrient (Unit/day)	Whol day	Breakfast	Lunch	Dinner	Snack	p^a	p^b
Total weight (g)	1061 ± 404	146 ± 106^{de}	391 ± 326^{df}	293 ± 145^{e}	230 ± 202^{f}	<0.01	<0.01
Energy (kcal)	1787 ± 604	318 ± 197^{d}	579 ± 367^{d}	432 ± 249	458 ± 409	<0.01	<0.01
Protein (g)	57.1 ± 20.5	10.4 ± 9.8^{de}	19.3 ± 10.7^{df}	17.4 ± 11.1^{eg}	10.0 ± 10.7^{fg}	<0.01	<0.01
Lipid (g)	54.0 ± 27.1	10.8 ± 10.2^{d}	20.2 ± 17.9^{def}	11.9 ± 11.9^{e}	10.9 ± 12.5^{f}	<0.01	<0.01
Carbohydrate (g)	272.7 ± 107.2	47.2 ± 31.7	79.2 ± 73.9	63.4 ± 45.0	82.9 ± 77.4	<0.05	<0.05
Minerals							
Calcium (mg)	502 ± 390	156 ± 228	115 ± 169	123 ± 145	108 ± 137	n.s.	n.s.
	411 (1.8)	73 (3.9)	80 (2.0)	81 (2.8)	50 (4.7)	n.s.	n.s.
Phosphorus (mg)	747 ± 335	151 ± 128	221 ± 175	208 ± 130	167 ± 204	n.s.	n.s.
	685 (1.5)	97 (3.7)	188 (1.7)^{d}	155 (2.9)^{e}	72 (5.6)^{de}	<0.01	<0.01
Iron (mg)	15.0 ± 9.9	4.0 ± 8.0	3.9 ± 3.7	3.6 ± 2.9	3.5 ± 4.1	n.s.	n.s.
	13.0 (1.6)	2.0 (3.2)	3.1 (1.8)	2.7 (2.4)	1.9 (3.8)	n.s.	n.s.
Vitamins							
Vitamin A (μg RE[c])	500 ± 770	96 ± 190	105 ± 97	235 ± 747	64 ± 138	n.s.	n.s.
	325 (2.3)	30 (5.5)^{d}	69 (3.0)^{e}	63 (5.2)^{f}	11 (8.0)^{def}	<0.01	<0.05
Vitamin B_1 (mg)	0.65 ± 0.30	0.12 ± 0.10	0.17 ± 0.11	0.16 ± 0.11	0.20 ± 0.24	n.s.	n.s.
	0.58 (1.6)	0.08 (3.0)	0.13 (1.9)	0.12 (2.5)	0.10 (4.2)	n.s.	<0.01
Vitamin B_2 (mg)	0.79 ± 0.44	0.19 ± 0.19	0.18 ± 0.11	0.23 ± 0.34	0.19 ± 0.22	n.s.	n.s.
	0.79 (1.6)	0.12 (3.3)	0.16 (1.6)	0.15 (2.4)	0.10 (3.7)	n.s.	n.s.
Niacin (mg)	22.0 ± 32.3	6.9 ± 28.6	7.1 ± 15.7	4.9 ± 3.9	3.1 ± 3.1	n.s.	n.s.
	15.7 (2.0)	2.2 (3.1)	4.3 (2.2)^{d}	3.4 (2.8)^{e}	1.6 (4.3)^{de}	<0.01	<0.01
Vitamin C (mg)	28.4 ± 24.3	3.2 ± 9.7^{d}	7.9 ± 9.4	13.2 ± 17.9^{de}	4.1 ± 10.6^{e}	<0.01	<0.01
	17.0 (4.1)	0.3 (6.6)^{de}	1.9 (9.3)^{df}	4.1 (8.1)^{eg}	0.4 (7.9)^{fg}	<0.01	<0.01

Values are AM $\pm$ ASD ($n=45$). GMs (GSDs in parentheses) are also gdven for minerals and vitamins because ASDs are often greater than the corresponding AMs. Means (on the same line) with the same superscript letters (of d, e, f and g) and significantly different from each other ($p<0.05$ as examined by multiple comparison test among four meals).

[a]p Values are for the differences among four meals (i.e., breakfast, lunch, dinner and snack) as examined by ANOVA (n.s. [not significant] indicates $p>0.05$).

[b]p Values are for the differences among three meals (i.e., breakfast, lunch and dinner) as examined by ANOVA (n.s. [not significant] indicates $p>0.05$).

[c]In retinol equivalency.

TABLE 5. *Relative weight of three meals and snack as sources of protein, lipid and carbohydrate*

	Breakfast	Lunch	Dinner	Snack	Whole day
Energy	18±10	32±14	24±13	26±15	100
Protein	18±12	34±17	30±16	18±13	100
Lipid	20±15	37±21	22±18	20±16	100
Carbohydrate	17±10	29±15	23±15	31±18	100

Values are the average accounts (in %; $n=45$) taking a whole day intake as 100%.

Relative weight of three meals and snack was compared as the sources of energy and three major nutrients (Table 5). Thus, lunch was more important meal of a day than dinner concerning the intakes of energy (32% for lunch vs. 24% for dinner; $p<0.01$) and protein (34% for lunch vs. 30% for dinner; $p<0.10$). Moreover, lunch was rich in lipid (38%). Whereas breakfast was light, snack contributed a substantial part of the total food with the largest intake of carbohydrate (31%). Additional information from the interview revealed that people took snacks several times a day, e.g., in mid-morning (around 10 a.m.), in mid-afternoon (around 3 p.m.) and also before retiring for the night.

Sources of energy and major nutrients by food group

Table 6 shows net (in kcal for energy and in g for nutrients) and relative weight (in %) of various food groups as the sources of energy and major nutrients. Because the Food Composition Tables used (Food and Nutrition Research Institute 1990, 1997) consisted of two parts, Part A for raw and cooked foods and Part B for processed food, calculation for the sources was made first by two parts separately (top two thirds in Table 6), and the results were combined (the bottom third of Table 6) so that intake sources were presented in five groups of 1. cereals, 2. fruits and vegetables, 3. meat and poultry, 4. eggs and dairy products, and 5. fish and shellfish.

The calculation made it clear as expected that cereals were the largest sources of carbohydrate and therefore of energy as expected. Meat and poultry accounted for the largest portion of protein (36%) and lipid (33%); additional information from menu records suggested that beef was the most favored food among meats. Protein of cereals accounted secondary to meat and poultry. In contrast, fish and shellfish accounted only 15% of protein or less than a half of that from meat and poultry, suggesting that the consumption of fish and shellfish was not large. The amounts of fruits and vegetables consumed were also small (i.e., 160 g or 15% of total food weight).

Consumption of cereals, especially rice

Rice intake was specifically examined because it was known that rice was a

TABLE 6. *Sources of major nutrients*

Food group	Weight (g)	Energy (kcal)	Protein (g)	Lipid (g)	Carbohydrate (g)
	Nutrint				
Total	1061 (100%)	1787 (100)	57.1 (100%)	54.0 (100%)	272.7 (100%)
Part A: Raw & cooked foods					
1. Cereals & grain produhts	355 (34%)	489 (29%)	7.8 (15%)	1.2 (2%)	108.3 (43%)
2. Fruits	59 (5%)	46 (3%)	0.5 (1%)	0.3 (0%)	11.7 (4%)
3. Vegetables	73 (7%)	51 (3%)	3.0 (5%)	2.4 (3%)	5.3 (2%)
4. Meat & poultry	79 (8%)	167 (10%)	15.3 (28%)	11.4 (21%)	0.1 (0%)
5. Milk & eggs	11 (1%)	23 (1%)	1.3 (2%)	1.8 (2%)	0.3 (0%)
6. Fish & shellfish	39 (4%)	42 (3%)	7.4 (13%)	1.0 (3%)	0.2 (0%)
7. Miscellaneous	8 (1%)	0 (0%)	0.0 (0%)	0.0 (0%)	0.0 (0%)
Part B: Processed foods					
1. Cereal products	21 (3%)	45 (3%)	0.6 (1%)	0.3 (1%)	9.7 (5%)
2. Bakery products	92 (9%)	279 (15%)	8.1 (14%)	4.9 (9%)	51.7 (18%)
3. Fruit & veg. products	28 (2%)	62 (3%)	0.9 (2%)	1.5 (3%)	12.2 (4%)
4. Meat & poultry products	29 (4%)	24 (5%)	4.4 (8%)	7.2 (13%)	1.8 (1%)
5. Egg & dairy products	25 (3%)	56 (3%)	2.9 (5%)	2.7 (5%)	5.3 (2%)
6. Fish, shellfish etc.	5 (0%)	9 (0%)	1.3 (2%)	0.3 (1%)	0.2 (0%)
7. Sugar & sugar products	92 (8%)	176 (9%)	0.2 (0%)	0.9 (2%)	44.3 (15%)
8. Fats and oils	18 (2%)	152 (9%)	0.0 (0%)	17.2 (34%)	0.0 (0%)
9. Miscellaneous	120 (10%)	100 (5%)	3.4 (5%)	0.8 (2%)	21.6 (7%)
Combination					
1. A1+B1+B2 (Cereals)	468 (46%)	813 (46%)	16.5 (30%)	6.4 (12%)	169.7 (65%)
2. A2+A3+B3 (Fruits & veg.)	160 (15%)	159 (8%)	4.4 (8%)	4.2 (6%)	29.2(10%)
3. A4+B4 (Meat & poultry prod.)	108 (12%)	191 (15%)	19.7 (36%)	18.6 (33%)	1.9 (1%)
4. A5+B5 (Eggs & dairy prod.)	36 (4%)	79 (4%)	4.2 (7%)	4.5 (7%)	5.6 (2%)
5. A6+B6 (Fish & shellfish)	44 (4%)	51 (3%)	8.7 (15%)	1.3 (3%)	0.4 (0%)

Values are AM daily intake (% in parentheses taking the sum of the all groups as 100%; $n=45$). The sum of percentages for 16 food group (i.e., 7 groups in Part A and 9 groups in Part B) may not make up to 100% (as expected); this is due to rounding of the first figure below the decimal point of each percentage. Classification of foods in Part 1 and 2 is after Food and Nutrition Research Institute (1990, 1997). For details of the classification, see the nutritional evaluation section in Materials and Methods.

TABLE 7. *Energy intake from major cereals by age group*

Age group (years)	Number	Rice	Wheat	Maize	Total[a]
29 or less	9	495±153 (87%)	69±115 (12%)	6±18 (1%)	570±192 (100%)
30-39	18	528±406 (75%)	110±245 (16%)	70±110 (9%)	708±505 (100%)
40 or more	18	523±116 (75%)	79±104 (11%)	100±128 (14%)	702±206 (100%)
All[b]	45	519±218 (77%)	90±174 (13%)	69±113 (10%)	78±353 (100%)

Values are AM±ASD on an energy basis (i.e., in kcal). Values in parentheses are % contribution in the sum of three cereals. There is no significant ($p>0.05$) differece in scosumption f rice, wheat, maize or the sum among the three age groups as examined by ANOVA.

[a]Sum of the three cereals.

[b]All age groups.

staple food for the population studied. For this purpose, 51 rice-related food items (including Code Numbers 101 014 [cooked rice] and 101 023 [cooked glutinous rice]) were sorted to figure out rice weight by summation. Among them, cooked rice accounted for 87%, being almost exclusive forms of rice consumed. Perusal of menu records suggested that wheat (basically as flour and mostly in forms of bread, noodles and cakes) and maize (as maize starch to prepare bread and cakes) were also consumed.

Comparison on an energy basis among the three age groups (Table 7) showed that there was no difference ($p>0.05$ by ANOVA) in rice or wheat consumption among different age groups when compared on an energy basis. ASDs for wheat were however generally larger than the corresponding AMs. Regarding maize consumption, simple comparison of AMs suggest that those at higher ages tended to take more maize (100 kcal/day for ≥40 year-old women) than those at younger ages (6 kcal/day for those at the ages of 29 years or less), but the difference was statistically insignificant ($p>0.05$ by ANOVA) possibly due to large ASDs.

Overall, the women depended primarily on rice among the cereals (519 kcal/day from rice out of 678 kcal/day from the three cereals [or 77%] on an energy basis) and quite less on wheat (90 kcal/day or 13%) and maize (69 kcal/day or 10%). Further breakdown of rice consumption by occasion of food intake showed the women took 12%, 49%, 34% and 5% of daily consumption at breakfast, lunch, dinner and snack, respectively, indicating that almost a half of the total rice for one day was taken at lunch.

Observation in anthropometry

Anthropometry results are summarized in Table 8, in terms of height, weight and BMI. Comparison among the three age groups showed that there was no

TABLE 8. *Anthropometry of study participants*

Age group (years)	Number	Heght (H) (cm)	Weight (W) (kg)	BMI ($W/H^2 \times 10^4$)	Overweight cases (%)[a]
29 or less	9	152.2±5.8	52.3±14.8	21.9±5.0	2 (22)
30-39	18	152.5±6.0	55.7±15.2	23.4±5.2	5 (28)
40 or more	18	151.9±5.7	54.5±7.4	23.2±3.0	5 (28)
All[b]	45	152.2±5.7	54.5±12.3	23.0±4.3	12 (27)

Values are AM±ASD. No significant ($p>0.05$) difference was observed among the three age groups as examined by ANOVA (in height, weight and BMI) or chi-square test (in prevalence of overweigt cases).

[a]Cases with BMI of ≥25 (James et al. 1989; Fatimah et al. 1995a).

[b]AM±ASD ages of the 45 women (i.e., the three age groups in combination) are 37.2±10.0 years.

significant ($p>0.05$ by ANOVA) difference in height, weight or BMI. Overall prevalence of over-weight cases was 27% (i.e., 12 cases among 45 women), with no biased distribution among the three groups ($p>0.05$ by chi-square test).

Clinico-laboratory findings

In hematology, hemoglobin (Hb) concentration was 12.9±1.0 g/100 ml blood (as AM±ASD). Among the 45 women, 6 cases of subclinical hypohemoglobinemia were detected, i.e., one case with 10.2 g Hb/100 ml and 5 cases with 11.1 to 11.7 g Hb/100 ml. Among the 6 cases, the woman (33 year-old) with the lowest Hb (i.e., 10.2 g Hb/100 ml) however had normal RBC counts (454×10^6 cells/mm^3), whereas another woman (40 year-old) with 11.2 g Hb/mm^3 had reduced RBC counts (346×10^4 cells/mm^3). None of the 45 women had leukocytopenia.

In serum enzyme studies, two women showed subclinical increases in AST and ALT (i.e., a 31 year-old woman with 43 IU AST/liter and 39 IU ALT/liter, and a 64 year-old woman with 42 IU AST/liter and 66 IU ALT/liter). The former had elevated triglyceride (TG; 194 mg/100 ml) and total cholesterol (231 mg/100 ml) but her HDL-cholesterol level remained normal (60 mg/100 ml). The latter also had elevated TG (232 mg/100 ml) but normal total cholesterol (187 mg/100 ml) and low HDL-cholesterol (31 mg/100 ml). Both women were negative to HBV (i.e., HBs-Ag, anti-HBs and anti-HBc) and HCV (anti-HCV_2) infection markers. Five other women showed slightly elevated ALT (37 to 55 IU/liter) but normal AST (27 to 39 IU/liter). γ-GTP stayed normal in all women. ALP, LAP and LDH levels were also normal in all, and none showed decrease in cholinesterase activity in serum.

In serum chemistry, all women had total protein and albumin at normal levels (i.e., 7.1 to 8.5 g/100 ml and 4.1 to 5.2 g/100 ml, respectively), and a normal A/G ratio (1.10 to 1.86). BUN and creatinine levels were also normal in all women (i.e., 15.7 mg/100 ml or less, and 1.2 mg/100 ml or less, respectively). Uric acid levels were slightly elevated in four women (6.6 to 8.6 mg/100 ml) with no clinical sign of gout.

Correlation among nutrient intakes, clinico-laboratory findings, and anthropometry observation

Possible relationship among nutritional parameters (i.e., intakes of major nutrients and iron), nutrition-related parameters in hematology (Hb) and serum biochemistry (albumin, total protein, total cholesterol and triglyceride), BMI and age was examined by regression analysis. As expected, Hb related significantly ($p<0.01$) with dietary intakes of iron ($r=0.733$) and to a lesser extent protein ($r=0.303$). BMI showed significant ($p<0.01$) correlation with triglyceride levels in serum ($r=0.531$), whereas the triglyceride level related significantly ($p<0.01$) with intakes of energy ($r=0.357$) and protein ($r=0.464$) as well as the age of the subject ($r=0.368$) but not with dietary lipid intake ($r=0.196$, $p>0.10$).

Discussion

The present study on a group of 45 working women in Manila showed that the women took sufficient energy and protein, and that lipid intake appeared to be barely non-excess (Tables 2, 3). Intakes of most minerals and vitamins, especially vitamin B_1 and iron, appeared to be insufficient, when evaluated in comparison with the RDA values (RDA Committee 1989). The evaluation might need cautions because the food duplicate collection was made on one day and the collected sample might not be very representative (Garn et al. 1976). The study subjects were however carefully instructed to provide typical foods of usual days. The two food customs that lunch is the most substantial meal of a day, and that energy intake via snack is also large (Table 5) are common to the present study population in Manila and to those in Kuala Lumpur (Shimbo et al. 1996c), in contrast to those in Japan (Ikeda et al. 1998; Yamada et al. 1996) and in Mainland China (Zhang et al. 1997a) for whom dinner is the most substantial meal.

Substantial numbers of study reports have been published in the Philippines by virtue of National Nutrition Surveys. Florentino et al. (1992a) reported that there had been steady improvement, e.g., from 1750 kcal/day (assumedly men and women in combination) in 1973 as national average energy intake to a peak of greater than 2500 kcal/day in 1982, which was then followed by a slight recess to a level slightly higher than 2300 kcal/day in 1985. The value reported for 1993 was 1684 kcal/day (Villavieja et al. 1995a).

In Metro Manila (Florentino et al. 1992b), however, both energy and protein intakes stayed unchanged (i.e., without any recess) from 1974 to 1987 at the levels around 1750 kcal/day and 50 g/day, respectively. The two reports (Florentino et al. 1992a, b) when combined may suggest that problem of insufficient energy intake may be more severe in rural areas than in the cities as Flores et al. (1994)

noted. The present observation of the intakes of 1787 kcal and 57 g protein/day by women may indicate a further improvement in recent years, although the population studied was limited to working women in Manila. It should also be noted that the value in the present study was obtained from adult women, whereas those reported by Florentiono et al. (1992a, b) and Villavieja et al. (1995) are on a per capita basis ignoring possible age- and sex-dependent difference in, e.g., energy intake.

Insufficiencies in mineral and vitamin intakes were observed not only in the present study (Table 3) and but in that by Kuizon et al. (1994a) and in the report of Villavieja et al. (1995a). It appears likely that these insufficiencies have been long-lasting nation-wide problems both in towns and in villages (Guzman et al. 1994).

It was also confirmed that rice is the real staple cereal for the women studied. This observation is in a close agreement with the descriptions by Florentino and Pedro (1992) and Florentino et al. (1992b) who reported that from the mid-1970s through-out the 1980's people depended mostly (84 to 88% by cereal weight) on rice with small consumption of maize (10% or less) and other cereals (about 5%) in addition. Florentino et al. (1992a) further described that rice and to a lesser extent maize are key cereals controlled by governmental policies. It may be necessary to take into account when extrapolating the present observation to other regions, however, that the present study population was in Manila in the northern Philippines, and that people in southern part (e.g., Mindanao) may take more maize than the northerners and that rural people may consume also starchy roots and tubes in addition (Villavieja et al. 1995a).

Regarding protein sources, the present study results agree with the observation by Villavieja et al. (1995a) in that people consume little milk and dairy products, but differs in that the 45 women take more beef rather than fish whereas the Filipinos as a whole (thus including villagers) depend more on fish and fish products (Villavieja et al. 1995a), the difference being a very probable reflection of the gradual changes in food habits in urbanized areas. It is worthy to cite that, for the Filipinos in general, cereals are among the leading sources of protein as well as calcium (Table 6 and Villavieja et al. 1995a).

In the Fourth National Nutrition Survey, pale conjunctiva (as a sign of anemia) was noted in 19.2% of the population studied (both sexes and all ages combined), the prevalence being higher in pregnant (34.3%) and lactating women (32.8%) than in others, and the lowest in Metro Manila (Velandria et al. 1995). Such difference was further confirmed by Hb determination so that the AM Hb concentration of 20 to 59 year-old women (excluding pregnant or lactating women) was 12.6 g/100 ml blood for urban populations whereas it was 12.3 g/100 ml among rural people. Prevalence of anemia was not very high in the present study, and most cases were subclinical with 12.9 g Hb/100 ml blood as an average, possibly in an agreement with the observation of lower anemia prevalence in the

Manila area by Velandria et al. (1995).

A discrepancy may be noted between the low anemia prevalence in the present study population and the high iron insufficiency ratio of 73% (Table 3). At least three possibilities can be considered. One is that the RDA for iron of 26 mg/day for 20-49 year-old women (set in the 1980's [RDA Committee 1989]) might be simply too demanding, e.g., when compared with the counterpart values of 12 mg/day for Japanese women (Ministry of Health and Welfare 1994). In fact, the RDA Committee (1989) gives a note on iron supplementation because they believe that it is hard to meet iron RDA for women of menstruating ages by usual diet in the Philippines (see the footnote to Table 1).

Alternatively, bioavailability of iron might have been improved in the Philippines since the time when the RDA was set as a result of gradual changes in dietary habits, especially among Manila citizens who take beef as a major protein source (Table 6). In 1986, Filipinos took 47% of iron from cereals (Kuizon et al. 1994b) and the average bioavailability of iron from regional meals at that time was estimated to be 5.6% (Trinidad et al. 1986). In contrast, the iron RDA of 12 mg/day for Japanese women is based on the assumed bioavailability via Japanese foods of 15% (Ministry of Health and Welfare 1994). The reliability of Food Composition Tables as database for the estimation of mineral intake may also be debatable. This possibility has been currently examined by this study group (e.g., Moon et al. 1996; Zhang et al. 1997b).

Overall, the current low anemia prevalence among the 45 women may indicate an improvement from the situation in 1987; at that time the AM Hb concentration in 20 to 59 year-old Filipino women was 12.3 g/100 ml, the value among pregnant women was 11.0 g/100 ml and 47.5% of the pregnant women had less than 11 g Hb/100 ml (Kuizon et al. 1989, 1994a). In this connection, the report by Florentino et al. (1996b) is worthy of attention; they observed in 1987 that anemia prevalence was higher among the undernourished than among the adequately nourished, which suggests that protein-energy deficiency might have played a role in etiology of anemia. Tanchoco and Rodriguez (1995) reported that 21% of the women of the 1987 study had BMI of less than 18.5, and that 3.5% of the women had BMI of as low as <16, both indicating rather high prevalence of nutritional deficiency at that time. In fact, the average BMI of the 45 women (23; Table 8) was larger than the counterpart value for 20-59 year-old women in the Fourth National Nutrition Survey (21.3, calculated by the present authors from the data presented by Villavieja et al. [1995b]). Although based on limited number of subjects and one-day food collection, the present observation on positive correlations of the Hb level with dietary intakes of not only iron but protein, is apparently on line with the reports by Tanchoco and Rodriguez (1995) and Florentino et al. (1996b).

Acknowledgments

The authors are grateful to Professor V.F. Chan, the Dean of the College of Public Health, the University of the Philippines, for her interest in and support to this work.

References

1) Acheson, K.J., Campbell, I.T., Edholm, O.G., Miller, D.S. & Stock, M.J. (1980) The measurement of food and energy intake in man —— An evaluation of some techniques. *Am. J. Clin. Nutr.*, **33**, 1147–1154.
2) Adair, L.S. & Guilkey, D.K. (1997) Age-specific determinants of stunning in Filipino children. *J. Nutr.*, **127**, 314–320.
3) Committee on Diet and Health, U.S. National Research Council (1989) *Diet and Health*, National Academy Press, Washington D.C., pp. 609–672.
4) Fatimah, A., Md. Idris, M.N., Romzi, M.A. & Faizah, H. (1995) Perception of body weight status among office workers in two government departments in Kuala Lumpur. *Malaysian Journal of Nutrition*, **1**, 11–19.
5) Florentino, R.F. & Pedro, R.A. (1992) Nutrition and socio-economic development in Southeast Asia. *Proc. Nutr. Soc.*, **51**, 93–104.
6) Florentino, R.F., Villavieja, G.M., Escano, F.F. & Raymundo, B.E. (1992a) Food and nutrition problems of urban centers: Metro Manila as a case study. Part I —— The country situation. *Journal of the Nutritionists and Dietitians' Association of the Philippines*, **6**, 90–101.
7) Florentino, R.F., Villavieja, G.M., Boquecosa, J.P. & Bacos, F.F. (1992b) Nutrition situation in Metro Manila. *Southeast Asian J. Trop. Med. Public Health*, **23**, Suppl. 3, 31–45.
8) Florentino, R.F., Corpus, V.A., Guzman, M.P.E. de, Angeles, C.C.C., Cardino, I.Q. & Jamorabo, A.C. (1996a) *Food Exchange List for Meal Planning*, Food and Nutrition Research Institute, Department of Science and Technology, Manila.
9) Florentino, R.F., Tanchoco, C.C., Rodriguez, M.P., Cruz, A.J. & Molano, W.L. (1996b) Interactions among micronutrient deficiencies and undernutrition in the Philippines. *Biomed. Environ. Sci.*, **9**, 348–357.
10) Flores, E.G., Tanchoco, C.C., Duante, C.A., Rodriguez, M.P. & Velandria, F.V. (1994) Nutrition survey in selected regions of the Philippines, 1986. Part B: Anthropometric assessment. *Phil. J. Nutr.*, **41**, 72–80.
11) Food and Nutrition Research Institute (1990) *Food Composition Tables Recommended for Use in the Philippines*, Food and Nutrition Research Institute, Department of Science and Technology, Manila.
12) Food and Nutrition Research Institute (1997) *The Philippine Food Composition Tables 1997*, Food and Nutrition Research Institute, Department of Science and Technology, Manila.
13) Garn, S.M., Larkin, F.A. & Cole, P.E. (1976) The problems with one-day dietary intakes. *Ecol. Food Nutr.*, **5**, 245–247.
14) Guzman, M.P. de, Villanueva, G.M., Pedro, M.R. & Raymundo, B.E. (1994) Coping with food and nutrition problems in the Philippines. *Phil. J. Nutr.*, **41**, 93–104.
15) Guzman, M.P. de, Claudio, V.S. & Leon, S.Y. de. (1995) *Basic Foods for Filipinos*, Merriam Webster, Manila.
16) Ikeda, M., Watanabe, T., Kasahara, M. & Nakatsuka, H. (1988) Nutrient intake of women in rural and urban areas in Japan. *Asia Pac. J. Public Health*, **2**, 28–32.
17) James, W.P.T., Ferro-Luzzi, A. & Waterlow, J.C. (1989) Definition of chronic energy deficiency in adults. Report of a working party of the International Dietary Energy Consultative Group. *Eur. J. Clin. Nutr.*, **42**, 969–981.

18) Kuizon, M.D., Tajaon, R.T., Madriaga, J.R., Perlas, L.A. & Desnacido, J.A. (1989) Assessment of iron status of Filipino pregnant women. *Southeast Asian J. Trop. Med. Public Health*, **20**, 461-470.
19) Kuizon, M.D., Cabrera, M.I.Z., Natera, M.G., Perlas, L.A., Desnacido, J.A., Cheong, R.L., Alberto, S.P. & Valdez, D.H. (1994a) Nutrition survey in selected regions of the Philippines, 1986. Part C: Biochemical assessment phase. *Phil. J. Nutr.*, **41**, 21-27.
20) Kuizon, M.D., Perlas, L.A., Cheong, R.L., Desnacido, J.A., Tajaon, R.T., Valdez, D.H. & Madriaga, J.R. (1994b) Third National Nutrition Survey, Philippines, 1987. Part C: Biochemical phase. *Phil. J. Nutr.*, **41**, 82-92.
21) Kuizon, M.D., Perias, L.A., Madriaga, J.R., Cheong, R.L., Desnacido, J.A., Marcos, J.M., Fuertes, R.T. & Valdez, D.H. (1995) *Fourth National Nutrition Survey Philippines, 1993. Part D. Biochemical Nutrition Survey*, Food and Nutrition Research Institute, Department of Science and Technology, Manila.
22) Ministry of Health and Welfare, the Government of Japan (1994) *Recommended Dietary Allowance for the Japanese* (5th revision; English version), Dai-ichi Shuppan Press, Tokyo.
23) Moon, C.-M., Zhang, Z.-W., Shimbo, S., Hokimoto, S., Shimazaki, K., Saito, T., Shimizu, A., Imai, Y., Watanabe, T. & Ikeda, M. (1996) A comparison of the food composition table-based estimates of dietary element intake with the values obtained by inductively coupled plasma atomic emission spectrometry: An experience in a Japanese population. *J. Trace Elem. Med. Biol.*, **10**, 237-244.
24) Moon, C.-M., Zhang, Z.-W., Imai, Y., Shimbo, S., Watanabe, T., Moon, D.-H., Lee, B.-K., Lee, S.-H. & Ikeda, M. (1997) Nutritional status of women in urban and rural areas in Korea as assayed by total food duplicate method. *Tohoku J. Exp. Med.*, **181**, 245-265.
25) Qu, J.-B., Zhang, Z.-W., Xu, G.-F., Song, L.-H., Wang, J.-J., Shimbo, S., Watanabe, T., Nakatsuka, H., Higashikawa, K. & Ikeda, M. (1997) Urban-rural comparison of nutrient intake by adult women in Shandong Province, China. *Tohoku J. Exp. Med.*, **183**, 21-36.
26) RDA Committee (1989) *Recommended Dietary Allowances for Filipinos*, 1989 Edition. Food and Nutrition Research Institute, Department of Science and Technology, Manila.
27) Shimbo, S., Imai, Y., Yasumoto, M., Yamamoto, K., Kawamura, S., Kimura, K., Watanabe, T., Sato, R., Iwami, O. & Ikeda, M. (1993) Quantitative identification of sodium chloride sources in Japanese diet by 24-hour total food duplicate analysis. *Journal of Epidemiology*, **3**, 77-82.
28) Shimbo, S., Kawamura, S., Yamamoto, K., Kimura, K., Imai, Y., Yasumoto, M., Watanabe, T., Iwami, O. & Ikeda, M. (1994) Reduced carbohydrate intake in past 10 years in two rural areas in Japan. *Ecol. Food Nutr.*, **33**, 123-130.
29) Shimbo, S., Higashikawa, K., Hatai, I., Murakami, M., Hayase, A., Watanabe, T., Moon, C.-S., Zhang, Z.-W. & Ikeda, M. (1996a) Chronological changes and inter-regional differences in dietary fiber intakes among middle-aged Japanese women. *Tohoku J. Exp. Med.*, **180**, 1-15.
30) Shimbo, S., Imai, Y., Tominaga, T., Gotoh, T., Yokota, M., Inoguchi, N., Ikeda, Y., Watanabe, T., Moon, C.-S. & Ikeda, M. (1996b) Insufficient calcium and iron intakes among general female population in Japan, with special reference to inter-regional differences. *J. Trace Elem. Med. Biol.*, **10**, 133-138.
31) Shimbo, S., Moon, C.-S., Zhang, Z.-W., Watanabe, T., Noor Hassim, I., Romzi, M.A., Md. Idris, M.N., Nakatsuka, H. & Ikeda, M. (1996c) Nutritional evaluation of working Malay women in Kuala Lumpur as studied by total food duplicate method. *Tohoku J. Exp. Med.*, **180**, 99-114.
32) Shimbo, S., Moon, C.-S., Zhang, Z.-W., Watanabe, T., Guo, Y.-L.L., Ma, W.-C.,

Nakatsuka, H., Peng, C.-J. & Ikeda, M. (1997a) Nutritional evaluation of Chinese working women in the city of Tainan, Taiwan. *Tohoku J. Exp. Med.*, **181**, 339-352.

33) Shimbo, S., Zhang, Z.-W., Qu, J.-B., Xu, G.-F., Song, L.-H., Wang, J.-J., Watanabe, T., Nakatsuka, H., Higashikawa, K. & Ikeda, M. (1997b) Urban-rural difference in cereals consumption in Shandong Province, China. *Tohoku J. Exp. Med.*, **183**, 211-220.

34) Steckel, R.H. (1983) Height and per capita income. *Historical Methods*, **16**, 1-7.

35) Tanchoco, C.C., Villadolid, M.F. & Cruz, A.J. (1994) Evaluation and revision of the Food Exchange List for meal planning. *J. Nutr. Dietit. Assoc. Phil.*, **8**, 52-58.

36) Tanchoco, C.C. & Rodriguez, M.P. (1995) Prevalence of energy intake-related problems among Filipinos based on body mass index as parameter. *J. Nutr. Dietit. Assoc. Phil.*, **9**, 82-86.

37) Trinidad, T.P., Madriaga, J.R., Valdez, D.H., Ponce, L.M., Cruz, E.M. & Sison, C.C. (1986) Non-heme iron availability from regional meals in the Philippines. *Phil. J. Nutr.*, **39**, 144-154.

38) Velandria, F.V., Magbitang, J.A., Tanchoco, C.C., Mendoza, T.S., Tangco, J.B.M., Mendoza, S.M., Duante, C.A., Cruz, E.O. de la, Orense, C.L. & Abarra, L.V. (1995) *Fourth National Nutrition Survey Philippines, 1993. Part C. Clinical Nutrition Survey*, Food and Nutrition Research Institute, Department of Science and Technology, Manila.

39) Villavieja, G.M., Cerdena, C.M., Molano, W.L., Lana, R.D., Boquecosa, J.P., Raymundo, B.E., Notes, C.A., Abaya, H.S.P., Palafox, E.F., Chavez, M.C., Burayag, G.A., Pine, C.R., Recuenco, J.R.D., Saturno, D.S. & Reyes, C.M. de los (1995a) *Fourth National Nutrition Survey Philippines, 1993. Part A. Food Composition Survey*, Food and Nutrition Research Institute, Department of Science and Technology, Manila.

40) Villavieja, G.M., Molano, W.L., Cerdena, C.M., Lana, R.D., Constantino, A.S., Tarrayo, E.R., Concepcion, D.S., Juguan, J.A. & Sario, I.S. (1995b) *Fourth National Nutrition Survey Philippines, 1993. Part B. Anthropometric Survey*, Food and Nutrition Research Institute, Department of Science and Technology, Manila.

41) Yamada, Y., Hirata, H., Fujimura, K., Ohtsuji, K., Tani, Y., Shimbo, S., Imai, Y., Watanabe, T., Moon, C.-S. & Ikeda, M. (1996) Disapperance of differences in nutrient intake across two local cultures in Japan: A comparison between Tokyo and Kyoto. *Tohoku J. Exp. Med.*, **179**, 235-245.

42) Zhang, Z.-W., Qu, J.-B., Moon, C.-S., Shimbo, S., Watanabe, T., Nakatsuka, H., Yin, S.-A., Hu, M.-L., Chen, Z.-Q. & Ikeda, M. (1997a) Nutritional evaluation of women in urban areas in continental China. *Tohoku J. Exp. Med.*, **182**, 41-59.

43) Zhang, Z.-W., Shimbo, S., Ochi, N., Eguchi, M., Watanabe, T, Moon, C.-S. & Ikeda, M. (1997b) Determination of lead and cadmium in food and blood by inductively coupled plasma mass spectrometry; a comparison with graphite furnace atomic absorption spectrometry. *Sci. Total Environ.*, **205**, 179-187.