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Food intake assessment of adults in rural and urban areas from four selected regions in Malaysia

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ABSTRACT

An assessment of the daily intake of major nutrients among 409 adults (males and females aged between 18-60 years, normal body mass index) residing in four regions in Malaysia was carried out as part of a major study on energy requirement. Subjects from both urban and rural areas completed a 3-day food record during the study. Mean energy intake among the men and women were 9.05 ± 2.21 MJ/day (2163 kcal/day) and 7.19 ± 1.60 MJ/day (1718 kcal/day) respectively, corresponding to 90% of the Malaysian RDA. A mean of 14% of the total energy was derived from protein, 23% from fat and 63% from carbohydrate. Energy intake amongst male subjects in the rural area (8.47 MJ/day, 2024 kcal) was significantly lower than their urban counterparts (9.52 MJ/day, 2275 kcal). There was no difference in mean energy intake in both the urban (7. 19 MJ/day, 1718 kcal) as well as rural women (7.16 MJ/day, 1711 kcal) corresponding to 86% of the RDA. The distribution of nutrients to the total energy intake amongst rural subjects were 13% for protein in both males and females, 65% for carbohydrate in males and 66% in females and 19% for fat in males and 21% for females. In the urban male and female subjects, the distribution of protein, carbohydrate and fat to the total energy intake were 14%, 55% and 29% and 30% respectively. The rural subjects showed a poorer mean intake of vitamins and minerals compared to the urban subjects. The diets of the male subjects in the rural area were deficient, less than two-third RDA in calcium, riboflavin and niacin. Calcium and iron intakes were less than two-third RDA in both the rural as well as the urban women. The rural women also had a poor intake of vitamin A and niacin. Overall, only protein and vitamin C intake met the RDA in most subjects from rural and urban areas.

INTRODUCTION

Habitual food consumption studies are important to carry out in order to study the relationship of diet to nutritional status, particularly to identify population at risks to inadequate intakes. It is also useful to collect data on the usual intake of the adult population for purpose of formulating dietary guidelines, recommended dietary allowances, national food policies, food fortification and food assistance programmes.

The adult years are the largest portion of a person’s lifespan. Good nutrition status would ensure optimum work performance and delay the onset of degenerative diseases in this age-group which are linked to a faulty diet (Evers, 1991). Food intake data of the adult population in Malaysia is

largely carried out as part of household food consumption surveys (Chong *et al* 1984, Mohd Ghazali *et al* 1986) rather than the adult population per se. Several selected studies on food intake has been reported, however the data is usually deemed not representative due to small sample size (Ismail, 1992).

A study on the energy requirements of adult Malaysians (Ismail *et al* 1993) was conducted between 1992-1993 of which assessment of food intake was a major component of this study. This paper reports the energy and major nutrient intakes of adults which was collected from four selected regions in Malaysia.

METHODS

Selection of study area

This study was part of a larger study to assess energy requirement of adult Malaysians divided by regions, namely Northern, Central, Southern and Eastern regions in Peninsular Malaysia and Sabah & Sarawak in East Malaysia. However, this paper will only report the food intake assessment from four selected regions namely Northern (Karangan & Pendang in Kedah), Southern (Johor Bahru, Skudai & Layang-Layang in Johor), Eastern (Kampung Bukit Payung and Kampung Raja in Besut, Terengganu) and Sarawak (Kampung Ensebang Plaie, Kota Samarahan and Kuching).

True randomisation in the selection of the study areas was difficult to achieve, however, discussions were held with the Social Economic Research Unit (SERU), Economic Planning Unit (EPU) and District Officers in each region to assist in the selection of areas to conduct the study. The study covered at least one urban and one rural area in each region in order to have an adequate sample of subjects.

In each area, the population was gathered at the local town hall. All those interested were then screened for antropometry and a questionnaire on past medical history, family history, smoking and drinking habits, socioeconomic background, activity level and food habits was administered by interview. All subjects who fit the study criteria (18-60 years, normal Body Mass Index) were approached and consents were obtained on a voluntary basis.

Subjects

Anthropometric measurements were carried out in a total of 1165 adults (males and females, aged 18-60 years) from the four regions. A subsample of 409 healthy subjects (males=212, females=197) with normal Body Mass Index for males, 20.1 - 25.0 kg/m^2 and females, 18.7 - 23.8 kg/m^2 (FAO/WHO/UNU 1985) were selected for the food intake study. Subjects were from the main ethnic groups in the regions namely, Malay, Chinese, Indian and Dayak, residing in either rural or urban areas.

Method

Body weight was measured in light clothing, without shoes to the nearest 0.1 kg using a digital SECA balance (Model 713 Germany). Height was measured to the nearest 0.1 cm using the SECA balance with height attachment. Body Mass Index (Wt/Ht^2) was calculated for each individual. Skinfold thickness measurements were taken using the Harpenden skinfold calipers (British Indicators, United Kingdom) at four sites as recommended by Durnin & Rahaman (1967) and body fat, as a percentage of body weight was calculated from the sum of four measurements of skinfold thickness (Durnin & Womersley, 1974).

Energy and nutrient intakes were measured using a 3-day food record method as described by Marr (1971). Food intake was recorded in standard household measures. Detailed description of all food and beverages (including brand names) and their method of preparation and cooking were recorded. For composite dishes, the amount of each ingredient used in the recipe and the amount consumed by the subject were also recorded. Local recipes of commonly eaten foods in the community were also obtained.

In urban areas, subjects were given specific instructions on how to record their food intake. In rural areas, food intake assessment were carried out with the assistance of field workers with at least an SPM (Sijil Pelajaran Malaysia) grade. They were recruited and trained for one week to record subjectsí food intake and later assigned to visit the homes of the subjects to record food eaten during each mealtime. Every food record was checked for completeness and accuracy in terms of portion sizes and ingredients recorded. Portion size measures were converted into grams from a list of common weight of foods which was previously compiled. Whenever possible, weights of portion sizes of foods such as kuehs, nasi lemak, fried noodles and others commonly sold in each area was obtained. Researchers stayed an average of 60 days in each area and the study was completed in two years between 1992-1994.

Energy and nutrient intakes were calculated using the Malaysian Food Composition Table (Tee *et al* 1988) and the Food Composition Table For Use in East Asia (FAO/US Dept of Health Education & Welfare, 1972). Mean intakes of nutrients were compared to the Malaysian RDA (Teoh, 1975). The ratio of energy intake (EI) to basal metabolic rate (BMR) was calculated for each subjects. BMR was measured in these subjects, as described in Ismail *et al* (1993).

Statistical analysis

Statistical analysis was performed using the Statistical Analysis Package (SAS). Groups of subjects were compared by analysis of variance (ANOVA) and the Duncan test. $P<0.05$ was considered to be significant in all statistical tests.

RESULTS AND DISCUSSION

A total of 409 subjects (212 males, 197 females) completed the 3-day food record. An almost equal number of subjects were obtained from the rural (51%) as well as the urban areas (49%) as shown in Table 1. In the rural areas, majority of the subjects were Malays (60%), followed by Indians (21%), Dayaks (18%) and only 1% were Chinese. In the urban areas however, the subjects were 36% Chinese, 35% Malays, 22% Indians and 7% Dayaks.

Table 2 shows the antropometric data for the population studied. The mean age of the male subjects was 39 ± 9 years whilst the mean age of the female subjects was slightly younger at 37 ± 10 years. All subjects had normal BMI as part of the inclusion criteria for the energy requirement study. However, the urban male subjects had significantly higher percentage body fat compared to the rural men. In the female subjects, percentage body fat was not significantly different.

Table 1. Description of subjects (n = 409)

	n	%
Gender		
Males	212	52
Females	197	48
Area		
Rural	209	51
Urban	200	49
Ethnicity		
Rural		
Malays	126	60
Chinese	2	1
Indians	44	21
Dayaks	37	18
Urban		
Malays	70	35
Chinese	72	36
Indians	44	22
Dayaks	14	7
Education Background		
None	98	24
Primary School	131	32
Secondary School / Vocational school	147	36
College/University	33	8

Energy and macronutrient intake

The mean daily intakes for energy, protein, fat and carbohydrates for males and females according to rural and urban areas are presented in Table 3. The mean energy intake for both male (9.05 (2.22 MJ/day, 2163 kcal) and female (7.19 (1.67 MJ/day, 1718 kcal) subjects were below the recommended daily allowances (RDA) for Malaysian adults. The mean energy intake basal metabolic rate (EI:BMR) ratio amongst male subjects was 1.59 and for females was 1.51, which were above the acceptable limit of 1.49 defined by Goldberg (1991), indicating that the energy intake was not under-reported as a group. Several other studies have also reported a below RDA intake in energy amongst adult Malaysians (Chong *et al* 1984; Zawiah *et al* 1984, Mohd Ghazali *et al* 1986, Ismail 1989, Chee 1989, Fatimah *et al* 1996).

Table 2. Anthropometric characteristics of subjects (mean ± SD)

	Age	Weight (kg)	Height (m)	Body Mass Index (kg/m²)	Body fat (%)	Lean body mass (kg)
Males						
Urban (n=117)	39±9[a] (19-58)	59.5±5.5[a] (48.4-71.4)	1.63±0.05[a] (1.48-1.77)	22.4±1.4[a] (20.1-25.0)	21.0±4.7[a] (6.9-30.3)	46.9±4.3[a] (35.4-59.3)
Rural (n=95)	39±10[a] (19-59)	56.8±4.8[b] (47.2-71.3)	1.61±0.05[b] (1.51-1.78)	219±4.1[b] (20.1-24.5)	18.3±4.1[b] (9.6-27.7)	46.3±3.9[a] (36.7-56.4)
Total (n=212)	39±9 (19-59)	58.3±5.3 (47.2-71.4)	1.62±0.05 (1.48-1.78)	22.2±1.4 (20.1-25.0)	19.8±4.6 (6.9-30.3)	46.7±4.1 (35.4-59.3)
Females						
Urban (n=83)	34±8[a] (18-51)	49.9±4.7[a] (39.8-63.7)	1.53±0.06[a] (1.40-1.68)	21.4±1.3[a] (18.8-23.8)	31.1±3.7[a] (22.5-38.2)	34.3±2.6[a] (27.1-41.7)
Rural (n=114)	39±10[b] (19-59)	47.5±4.6[b] (38.0-60.8)	1.50±0.05[b] (1.37-1.63)	21.2±1.5[a] (18.8-23.8)	30.3±4.5[a] (15.4-40.5)	32.9±3.1[b] (26.0-42.0)
Total (n=197)	37±10 (18-57)	48.5±4.8 (38.0-63.7)	1.51±0.06 (1.37-1.68)	21.3±1.4 (18.8-23.8)	30.7±4.2 (15.4-40.5)	33.5±3.0 (26.0-42.0)

Values with different superscripts show significant difference between group ($p<0.05$)
Values in bracket indicate range

Table 3. Mean intakes of energy, protein, fat and carbohydrate in subjects from rural & urban areas (mean ± SD)

	n	Energy (MJ/day)	Protein		Fat		Carbohydrate	
			g	%	g	%	g	%
Males								
Rural	95	8.47±2.32[a]	67±21[a]	13±3[a]	42±18[a]	19±7[a]	325±92[a]	65 ±10[a]
Urban	117	9.52±2.02[b]	77±20[b]	14±2[a]	55±20[b]	29±6[b]	251±82[b]	55±7[b]
Total	212	9.05±2.22	72±21	14±3	54±22	23±8	338±92	63±9
EI : BMR		1.51						
Females								
Rural	114	7.19±1.59[a]	56±16[a]	13±2[b]	39±16[a]	21±7[a]	285±71[a]	66±8[a]
Urban	83	7.16±1.62[a]	60±17[b]	14±3[b]	64±22[b]	30±6[b]	289±88[b]	55±7[b]
Total	197	7.19±1.67	57±17	14±3	44±17	23±8	273±72	63±9
EI : BMR		1.49						

Values with different superscripts show significant difference between group ($p<0.05$)
EI : BMR – Energy intake: Basal metabolic rate

Table 3 also shows that the mean energy intake amongst male subjects in the rural area (8.47 MJ/day, 2024 kcal) was significantly lower than their urban counterparts (9.52 MJ/day, 2275 kcal). Energy intake was not significantly different in both the urban (7.16 MJ/day, 1711 kcal) as well as rural women (7.19 kcal/day, 1718 kcal), and both were low compared to the Malaysian RDA, indicating that food habits may play a role. The mean distribution of nutrients to the total energy intake amongst rural subjects were 13% for protein in both males & females, 19% for fat in males & 21% for females and 65% for carbohydrate in males & 66% in females. In the urban male and female subjects, the mean distribution of protein, fat and carbohydrate to the total energy intake were 14%, 29-30% and 55% respectively. While these distribution were within the population nutrient goals recommended by WHO (1991) for the prevention of chronic disease, it is important to note that subjects in the urban areas consumed a significantly higher percentage energy from protein and fat and lower energy percent from carbohydrate compared to their rural counterparts.

Fat intake was not widely reported in other food consumption studies carried out in Malaysia. In this study, the total fat intake amongst rural subjects was 42g in males and 39g in females (corresponding to 19-21% of total energy) as shown in Table 3. This figure is slightly higher than the average fat intake of rural households reported by Chong et al (1984) that is, 38g per day (18% of total energy intake). Ng (1996) reported a fat intake analysis of 66g (26% energy) in the urban diet. Fatimah et al (1996) reported a fat intake of 57g (35% energy) in males and 51g (30% energy) in females living in the urban area. In this study, the urban subjects were found to consume 55g fat in males and 64g fat in females contributing to 29% and 30% of the total energy intake, respectively. However, subjects in this study consumed a lower energy intake compared to the urban population reported by Ng (1996) and a higher energy intake compared to subjects in Fatimah *et al* (1996) study.

The mean protein intake was more than adequate in the diets of subjects in this study. A detail analysis of the diets showed that the protein sources in the rural diet were mainly fish, legumes and eggs, while meat and chicken were more frequently consumed by the urban groups. This possibly contributed also to the higher fat intake among the urban subjects.

Vitamins and minerals

The intake of nutrients among male subjects (Table 4) did not meet the RDA for calcium, vitamin A, thiamin and riboflavin while niacin intake met less than two-third (67%) RDA in these subjects. In female subjects, mean intakes of vitamin A, thiamin, riboflavin and niacin were below the RDA, while calcium and iron intake met less than two-third RDA. Attention needs to be given to this finding of low iron and calcium intake in these women as it may predispose them to conditions such as anemia and low bone mass.

Table 4 also showed that generally, the rural subjects showed a poorer mean intake of vitamins and minerals compared to the urban subjects. The diet of the male subjects in the rural area was deficient (met less than two-third RDA) in calcium, riboflavin and niacin. Again, it is important to note that calcium and iron intake were less than two-third RDA in both rural as well as amongst the urban women. The rural women also had a poor intake of vitamin A and niacin. Overall, only protein and vitamin C met the RDA in all subjects from rural and urban areas.

Table 4. Mean intakes of energy, protein, vitamins and minerals of subjects from rural & urban areas (expressed as percentage RDA)

	Energy (MJ/day)	Protein (g)	Calcium (mg)	Iron (mg)	Vitamin A (ug RE)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin C (mg)
Males									
Rural (n=95)									
mean±SD	8.47±2.32	66±21	285±177	13±8	±376	0.8±0.6	0.9±0.5	10.2±9.1	44±57
% RDA	81	125	63	144	71	80	64	65	147
Urban (n=117)									
mean ±SD	9.51±2.02	77±20	373±134	15±7	768±539	0.9±0.9	1.1±1.1	9.9±9.9	49±49
%RDA	91	145	83	167	102	100	79	63	163
Total (n=212)									
mean±SD	90.5±2.20	72±21	333±161	14±7	661±487	0.9±0.5	1.0±0.5	10.1±7.1	47±47
%RDA	90	136	74	155	88	87	72	64	156
Females									
Rural (n=114)									
mean±SD	7.19±1.59	56±16	234±130	12±6	453±281	0.7±0.4	0.8±0.3	8.6±4.5	39±33
%RDA	86	137	52	43	60	88	67	66	130
Urban (n=83)									
mean±SD	7.19±1.65	60±18	283±133	13±7	580±330	0.7±0.4	0.9±0.4	9.2±6.8	57±55
%RDA	86	146	63	46	77	88	75	71	190
Total (n=197)									
mean±SD	7.19±1.60	57±16	255±133	12±7	506±308	0.7±0.4	0.8±0.4	9.0±6.0	47±44
%RDA	90	140	57	44	67	90	68	69	157

Table 5. Percentage subjects from rural and urban areas consuming energy and nutrients below two-third RDA in males and females.

	Males			Females		
	Rural (n=95)	Urban (n=117)	Overall (n=212)	Rural (n=114)	Urban (n=83)	Overall (n=197)
Energy (less than RDA)	79	67	73	73	72	72
Protein	0	0	0	0	0	0
Calcium	63	32	48	76	61	69
Iron	22	2	12	82	87	85
Vitamin A	56	27	42	58	51	55
Thiamin	52	20	36	29	22	26
Riboflavin	68	28	48	59	40	50
Niacin	77	77	77	66	59	63
Vitamin C	36	15	26	32	25	29

The percentage of subjects with dietary intake below two thirds of the RDA was found to be generally higher amongst the rural subjects compared to the urban subjects (Table 5). In males, majority of the rural subjects had inadequate intake of calcium (63%), vitamin A (56%),

riboflavin (68%) and niacin (77%). Similarly, overall in both the rural as well as urban areas, more than half of the female subjects had inadequate intake of calcium (69%), iron (85%), vitamin A (55%) and niacin (63%). An analysis of the diet records showed that factors which possibly contributed to low intakes of such nutrients were low total energy intake, poor consumption of meat, fruits, vegetables and milk products.

CONCLUSION

Improving the economy of the poor is important as low nutrient intakes was closely linked to poverty in the rural communities studied. On the other hand, subjects in the urban and sub-urban areas are financially able to have better supplies of a range of foods which enable them to consume more animal products, fruits and vegetables. While this would lead to improved dietary intake, this group needs to be educated on a healthier eating pattern to avoid chronic diseases due to affluence. However, the study showed that the quality of the diet in both the rural and urban diets needed to be improved, particularly intakes of important nutrients such as calcium and iron amongst the women. Indeed, nutritionists and dietitians have an important role in educating the adult population on improving their dietary intake in order to attain a better quality of life for the present and future generations.

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