Original Article

Diet, nutritional knowledge and health status of urban middle-aged Malaysian women

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The objective of the study was to assess nutritional and health status as well as nutritional knowledge in urban middle-aged Malaysian women. The impact of menopause on diet and health indices was also studied. The study included 360 disease free women, non users of HRT, aged ≥45 years with an intact uterus recruited from November 1999 to October 2001. Personal characteristics, anthropometric measurements and blood sample were acquired followed by clinical examination. Nutrient intake and nutritional knowledge was determined by a quantitative FFQ and KAP. The findings showed that urban middle-aged women, aged 51.65±5.40 years had energy intakes (EI) 11% below RDA, consisting of 53% carbohydrates, 15% protein and a 32% fat which declined with age. The sample which comprised of 42.5% postmenopausal women had a satisfactory diet and healthy lifestyle practices. Premenopausal women consumed more dietary fat (6%) with other aspects of diet comparable to the postmenopausal women. Iron intake was deficient in premenopausal women, amounting to 56% RDA contributing to a 26% prevalence of anaemia. Overall, calcium intake reached 440mg daily but dairy products were not the main source. The postmenopaused had a more artherogenic lipid profile with significantly higher total cholesterol (TC) and LDL-C, but more premenopausal women were overweight/obese (49% versus 35%). EI was the strongest predictor for BMI and waist circumference (WC), with WC itself an independent predictor of fasting blood sugar and TC with BMI strongly affecting glucose tolerance. High nutritional knowledge was seen in 39% whereas 20% had poor knowledge. Newspapers and magazines, followed by the subject's social circle, were the main sources of nutritional information. Nutritional knowledge was positively associated with education, household income, vitamin/mineral supplementation and regular physical activity but inversely related to TC. In conclusion, middle-aged urban women had an adequate diet with low iron and calcium intakes. Nutritional knowledge was positively associated to healthier lifestyle practices and lower TC. A comparable nutrient intake and lifestyle between pre and postmenopausal women suggested that health changes associated with menopause was largely independent of diet.

Key Words: food frequency, perimenopause, knowledge, health, middle-aged, women, urban, Malaysia

Introduction

The Second National Health and Morbidity Survey in 1996 showed that 16.6% and 4.4% of Malaysia's population was overweight and obese. In 2004, the obese population had risen to 12.2% and is estimated to reach 18.8% in 2010. By 2010, prevalence of diabetes is expected to double to 16.4%, hypertension 10.9%, hyperlipidaemia 22.8% following the increasing trend of obesity.[1] Furthermore, mortality from all causes, including cancer, was shown to be more common in obese individuals compared to those of normal body mass index.[2]

Currently 23% of the female population was overweight compared with 18% of the men; while 17% of urbanites were overweight against 15% in rural areas. Ethnic Indians had the highest number of overweight, followed by Malays and Chinese.[3] In efforts to gain insight into the 'obesity epidemic', studies on nutritional and health status have been carried out among children, adults and the elderly[4-9] with insufficient emphasis on middle-aged adults.[10]

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Improved healthcare system and better nutrition had seen increased average lifespan for females from 64.7 years in 1970[11] to 75.2 years in 2001.[12] Rapid industrialization and socio-economic progress had wrought major lifestyle changes and shifts in disease patterns within three decades with concomitant social and economic implications for the older population.[13] The study hoped to provide an insight into the nutritional and health status in urban middle-aged women as well as the relationship between nutritional knowledge and health indices. Comparisons were made between pre and postmenopausal women to see whether changes in health status due to menopause were associated with differences in diet and lifestyle.

Methodology

The study design was prospective cross sectional, carried out in a referral hospital (HUKM) situated in a residential suburb of the capital city. Recruitment was via distribution of 2000 flyers to residential areas around the hospital over a period of two years, but subjects from other areas responded as well after being informed by friends. Participants of the study were part of first year recruitment (November 1999 to October 2001) whereby 519 women underwent initial screening by telephone and 360 disease free women, non users of HRT, aged 45 years and above with intact uterus were accepted. Exclusion criteria included those with chronic diseases, on pharmacological treatment, secondary causes for osteoporosis and contraindication to HRT. The study was a Master of Science project [14] and had received approval from the medical faculty research ethics committee. It was part of a larger multi-centre study concerning women's health at perimenopause.

All subjects gave written informed consent upon participation in the study. Nutritional knowledge, attitude and practices (KAP) and quantitative food frequency questionnaire (FFQ) in three languages was administered by a trained dietitian. The KAP consisted of 20 questions with each correct answer given a score of 1. Based on a maximal score of 20 points, the subjects were categorised into poor (0-9, <50%), moderate (10-14, 50-<75%) and high (15-20, ≥75%) scores. Both FFQ and KAP were modified from the instrument developed by the Cardiovascular Intervention Group Study MOH-UIA-UKM-UM-UPM-USM-1998.[15-17] Subjects were asked to state the frequency of intake of each kind of food listed per day, week or month and serving size was based upon the Malaysian Food Composition Tables.[18] Food quantification was aided by food photographs, matchboxes and household utensils. To adjust for differences in age of subjects, the weighted nutrient intake method was used for comparison to Malaysian RDAs.[19] An energy intake (EI)/basal metabolic rate (BMR) ratio of <1.2 or >1.8 respectively indicated an estimation of EI below or above normal. Basal (BMR) was determined with the formula of Ismail *et al*.[20] Food intake was converted to gram and analyzed using the software Diet 4 which was based on the Malaysian Food Composition Tables.[18]

Height, weight, hip and waist circumference were measured twice and taken to the nearest 0.1 standard unit measurement [Health-O-meter,USA]. Blood was profiled for lipids, blood sugar and haemoglobin. Categorization for anthropometry, serum lipids, blood sugar and haemoglobin were according to population norms.[21-24] Personal characteristics, medical and reproductive history were collected via questionnaires in three languages i.e. English, Malay and Chinese. A clinical examination was carried out followed by ultrasound in the gynaecology clinic. Mammogram, chest X-rays and bone scan were later done to rule out the presence of existing disease.

Data was analysed using software SPSS version 9.0 [SPSS Inc, Chicago, USA]. Continuous variables were expressed as mean and standard deviation, and compared by the Student's t test. Categorical data were compared using the Chi-squared test. Relationships between variables were analysed by Pearson correlation and further tested by multiple regression analysis where appropriate. Differences were considered significant if $P<0.05$.

Results

Three hundred and sixty subjects participated in the study with an average age of 51.65 ± 5.40 years old; two fifths were in the age range of 45-49 and less than a tenth were above 60 years old (Table 1). Over two fifths (42.5%) were postmenopausal with an average age of menopause 49.89 ± 2.95 years old with a median of 50.0 years. The majority were Chinese, followed by Malays and Indians, reflecting an urban population distribution. Three quarters were married and significantly more premenopausal women had secondary and tertiary education compared to the post-menopausal, 85% versus 64% respectively ($P<0.001$). More premenopausal women were also currently employed ($P<0.001$) and hence had higher household income, 41.6% with monthly income above RM 3000 versus 21.0% for postmenopausal ($P<0.005$). The reproductive history was not significantly different between the two groups, except more post-menopausal women had reported using oral contraceptives (OCP) ($P<0.05$).

The majority practiced a healthy lifestyle with two thirds (62%) exercising regularly. The average time spent on exercises was 2.5±3.7 hours per week, significantly different between pre and postmenopausal women (2.2±3.4 versus 3.0±3.9 hours/week, $P<0.05$). Only 9% regularly took alcohol - mostly reported as a medicinal tonic - one drink per day or less. Few women smoked with only 1% being regular smokers. Two thirds reported taking vitamin supplements (66%) and half (51%) also took calcium supplements. Vitamins and minerals taken on a daily basis included A, B complex, C, D, E, folic acid, multivitamins, calcium and magnesium. Supplementary foods included Malay traditional supplements such as jamu, mengkudu juice, pegaga and gamat, a sea cucumber extract. Neem, a traditional Indian herb and Chinese herbs such a ginseng, pa-chen, dong guai and lingqi were reported as well. Other supplements reported included evening primrose oil, royal jelly, spirulina, gingko biloba, protein powder, garlic, ginger, bee pollen, blackcurrant seed oil, goat's milk, wheatgrass and barley grass. Overall, more premenopausal women practiced food and vitamin supplementation compared to the postmenopausal women.

Table 1. Personal characteristics of the participants

Background characteristics	All (*N*=360)	Premenopause (*N*=207)	Postmenopause (*N*=153)
	Mean±SD	Mean±SD	Mean±SD
Current age (yrs)*	51.65±5.40	48.39±2.51	56.07±5.12
Age of menarche (yrs)	13.50±1.66	13.37±1.46	13.67±1.90
Age of menopause (yrs)	NA	NA	49.89±2.95
Parity (no.)	2.93±1.73	2.89±1.63	2.96±1.86
Household income* (RM)	3382±3396	3897±3565	2686±3029
Age distribution	%	%	%
45-49	43.3	71.5	5.2
50-54	31.9	27.1	38.6
55-59	15.3	1.4	34.0
≥ 60	9.4	-	22.2
Ethnicity			
Malay	33.1	40.6	22.9
Chinese	61.1	55.1	69.3
Indian	5.0	3.4	7.2
Others	0.8	1.0	0.7
Marital status			
Single	10.0	8.7	11.8
Married	75.6	76.3	74.5
Widowed	10.0	10.1	9.8
Divorced/separated	4.4	4.8	3.9
Education *			
No formal schooling	3.9	1.0	7.8
Primary school	20.0	14.0	28.1
Secondary school	55.0	58.9	49.7
College/tertiary school	21.1	26.1	14.4
Income distribution* (RM)			
≤ 500	6.1	3.9	9.2
501-1000	18.9	15.5	23.5
1001-3000	42.2	39.1	46.4
3001-5000	18.1	23.7	10.5
> 5000	14.7	17.9	10.5
Nos. of childbirth distribution			
0	11.9	9.7	15.0
1-4	70.3	73.9	65.4
≥5	17.8	16.4	19.6
Smoking			
Never	96.7	95.7	96.7
Past user	2.2	1.9	2.6
Current user	1.1	2.4	0.7
Alcohol			
Never	88.9	89.4	88.9
Previous user	2.5	1.9	3.3
Current user	8.6	8.7	7.8
Previous OCP use *	35.8	31.4	41.8
Never breastfed	64.4	65.2	63.1
Regular physical activity	62.5	58.9	67.3
Supplementary vitamins intake	65.8	68.6	62.7
Supplementary calcium intake	51.1	52.7	49.0
Traditional medicine or supplementary foods intake	61.7	68.6	52.3

* P <0.005

Based on the FFQ (Table 2), fish was the main source of protein with 87% reporting consumption at least once a week followed by chicken, the second protein source in 67% of women. Meat intake was relatively low, <5% had meat daily, 50% 1-3 times weekly, a quarter (25%) once a month and a fifth (21%) being non meat eaters. In contrast, egg intake was high, with 53% having it twice per week or more. Intake of legumes was relatively frequent, 61% of women had beans twice or more per week. Consumption of fruits and vegetables was high, with 71% and 91% reporting daily intake. Cheese and yogurt intake was poor, 30% had it once a month and 36% never, while only 35% had milk daily. In contrast, a third (35%) and a quarter (24%) respectively had coffee and tea on a daily basis. Fast food was not popular among middle aged women, with 60% never having it. Pre and post-menopausal women had a comparable food intake except for a lower meat intake among the postmenopausal.

The majority of subjects (84%) ate breakfast every morning, but 8% rarely or never had breakfast. The reasons for avoiding breakfast included "no appetite" or because it was not usual practice to eat in the morning

Table 2. Food frequency of all subjects

	Frequency (%)				
N=360	Everyday	2-3 per wk	1 per wk	1 per mth	Never
Fish and seafood	36.8	50.6	7.5	3.3	1.7
Premenopause	39.1	47.8	7.7	4.3	1.0
Postmenopause	34.0	54.2	7.2	2.0	2.6
Poultry	13.1	53.9	20.3	7.2	5.5
Premenopause	13.0	56.0	18.4	8.7	3.9
Postmenopause	13.1	51.0	22.9	5.2	7.8
Meat	4.7	23.3	26.7	24.7	20.6
Premenopause	3.9	20.3	30.9	26.6	18.4
Postmenopause	5.9	27.5	20.9	22.2	23.5
Eggs	4.4	48.3	33.3	10.6	3.3
Premenopause	4.3	49.3	31.4	12.6	2.4
Postmenopause	4.6	47.1	35.9	7.8	4.6
Legumes and products	15.3	46.1	23.6	13.1	1.9
Premenopause	15.9	41.1	26.6	15.0	1.4
Postmenopause	14.4	52.9	19.6	10.5	2.6
Vegetables	91.1	6.9	1.1	0.8	-
Premenopause	90.8	7.7	1.4	-	-
Postmenopause	91.5	5.9	0.7	2.0	-
Fruits	70.6	22.2	5.0	1.4	0.8
Premenopause	68.6	24.6	4.3	1.9	0.5
Postmenopause	73.2	19.0	5.9	0.7	1.3
Cheese and yogurt	5.3	12.5	15.8	30.3	36.1
Premenopause	4.3	10.6	19.8	32.4	32.9
Postmenopause	6.5	15.0	10.5	27.5	40.5
Milk	34.7	18.9	10.6	13.3	22.5
Premenopause	30.9	22.2	12.6	15.5	18.8
Postmenopause	39.9	14.4	7.8	10.5	27.5
Coffee*	35.1	18.3	3.9	5.1	37.6
Premenopause	32.0	21.2	4.9	5.4	36.5
Postmenopause	39.2	14.4	2.6	4.6	39.2
Tea*	23.6	16.6	7.0	5.1	47.7
Premenopause	23.2	20.2	7.4	6.4	42.9
Postmenopause	24.2	11.8	6.5	3.3	54.2
Fastfood*	-	1.4	4.2	34.8	59.6
Premenopause	-	1.6	4.9	43.3	50.2
Postmenopause	-	1.3	3.3	23.5	71.9

*N = 356

(Table 3). Nearly half chose a simple breakfast consisting of bread, cookies or cereals while a quarter (24%) had noodles. Almost a third (31%) snacked once a day, mainly on bread, biscuits, cereals and local pastries. More postmenopausal women (35%) snacked daily compared to the premenopaused (29%). Rice was the staple food chosen by 65% and 79% for lunch and dinner respectively. It was usually eaten with fish, poultry and vegetables. The majority of subjects maintained a three meal pattern of light breakfast with a heavier lunch and dinner. Only 2% skipped lunch with 10% reporting light meals for lunch. Fewer (1%) skipped dinner and 9% practised light dinners consisting of bread, biscuits, cereals, local pastries, fruits or vegetables. Four fifths (79%) reported having dinner with their families. Some of those that reported skipping lunches and dinner made up for it by having snacks. Meal patterns between pre and post-menopausal women were similar.

Dietary analysis showed that total EI consisted of 53% carbohydrates, 15% protein and 32% fats. EI in pre and postmenopausal women reached 87% and 90% of the Malaysian RDA respectively with an estimated mean EI 11.5% below RDA (Table 4). Premenopausal women took more dietary fat daily, approximately 6% compared to the postmenopausal (P<0.01). Fruit and vegetable intakes were very high, leading to a high estimation of vitamin C intake. Calcium intake reached 100% RDA amongst post-menopausal women and 96% in pre-menopausal, an average of 440mg daily. Iron intake was 118% RDA in the postmenopausal, twice the level of premenopausal women, 56%.

Calculations showed that 86.5% of subjects had EI/ BMR ratio within the normal range, 13.5% had estimates below normal and none had higher. These proportions were similar for both pre and post menopausal women. A significant negative association was observed between age and fat intake (r=-0.119, P<0.05) which probably accounted for the difference in fat intake seen in pre-menopausal and post-menopausal women. A similar negative trend was observed for iron (r=-0.074) and EI (r=-0.048) which did not reach statistical significance. Dietary calcium showed a non significant relationship for age (r=0.044) and bone mass density of both spine (r=0.081) and hips (r=0.078).

Table 3. Food preference and dietary practices of participants

N=360	All %		Premenopause %		Postmenopause %	
	B/fast	Snack	B/fast	Snack	B/fast	Snack
≥2 times per day	NA	7.8	NA	7.7	NA	7.8
Everyday	83.9	31.4	81.2	29.0	87.6	35.3
2-3 times per week	10.3	15.8	13.5	19.8	5.9	10.5
Once per week	2.2	16.9	2.4	13.0	2.0	22.2
Seldom (2-3 per month)	1.4	27.8	1.4	30.4	1.3	24.2
Never	2.2	NA	1.4	NA	3.3	NA

Foods preference	Breakfast *N* (%)	Lunch *N* (%)	Dinner *N* (%)
Bread, cookies, cereals	172 (47.8)	15 (4.2)	11 (3.1)
Fried noodles/similar	47 (13.1)	33 (9.2)	10 (2.8)
Noodles soup/similar	41 (11.4)	50 (13.9)	18 (5.0)
Roti canai, thosai, sandwiches, sweet potatoes	32 (8.9)	1 (0.3)	7 (1.9)
Mixed rice, chicken rice, nasi lemak	16 (4.4)	234 (65.0)	284 (78.9)
Cakes/local pastries	11 (3.1)	2 (0.6)	1 (0.3)
Fruits, vegetables	5 (1.4)	18 (5.0)	19 (5.3)
Drinks only	29 (8.1)	5 (1.4)	4 (1.1)
No meal	7 (1.9)	2 (0.6)	2 (0.6)
Fastfoods (burger, hotdog, pizza, etc)	-	-	4 (1.1)

Table 4. Energy and nutrient intake of all subjects

	All women			Premenopause		Postmenopause	
Energy/nutrient intake[a]	Mean±SD	Range	%RDA	Mean±SD	%RDA	Mean±SD	%RDA
Energy (kcal)[b]	1615±226	1031-2304	88.5	1633 ±244	87.3	1591±198	90.3
Carbohydrate (g)	213.0±37.2	123-316		213.5±38.6		212.3±35.4	
Protein (g)	59.4±10.4	35-103	144.8	59.8±10.9	145.9	58.7±9.5	143.2
Fat (g) *	58.4±11.5	26-106		59.9±12.3		56.5±10.1	
Vitamin C (mg)	106.3±72.7	13-738	354.3	105.1±82.2	350.3	107.9±57.9	359.7
Calcium (mg)	440.3±210.0	26-1559	97.8	433.2±220.6	96.3	449.9±195.3	99.9
Ferrum (mg) [c]	12.4±4.8	4-41	71.9	12.7±5.3	56.4	11.9±4.0	117.8

[a]Four incomplete food frequency questionnaire; [b]All women (weighted energy intake) = 1824 kcal; Pre and postmenopausal (weighted energy intake) = 1871 kcal and 1761 kcal respectively; [c]All women (weighted iron intake) = 17.23 mg; Pre and postmenopausal (weighted iron intake) = 22.58 mg and 10.12 mg respectively. * Fat intake differed significantly between pre and postmenopaused (P<0.01)

Half of the study population had BMIs within the normal range. Significantly more premenopausal women were heavier and had BMIs =/>25kg/m^2 compared to the post-menopausal (49.3% versus 35.3%, P <0.05). The pre-menopausal had larger waist and hip circumferences than the postmenopausal, but these differences did not reach statistical significance (Table 5). As for health indices, one fifth of all subjects (19%) were anaemic (Table 6), especially amongst pre-menopausal women (26% versus 9% for postmenopausal, P<0.001). The former also had lower mean hemoglobin concentrations (P <0.01). Almost 5% and 16% were prediabetic in the fasted and 2 hour post-prandial state respectively with diabetes mellitus found in 4.5% of all subjects. Mean blood sugar was higher in post-menopausal than pre-menopausal women, but this did not reach statistical significance. In the fasted state, more postmenopausal women were prediabetic, 8% versus 2% in pre-menopausal although the proportion afflicted by diabetes was similar. A third had high total cholesterol (TC, 33%) and LDL-C (32%) levels whereas a quarter (27%) had high triglycerides (TG). Postmenopausal women had a more artherogenic lipid profile with higher mean TC and LDL-C compared to the premenopausal group (both, P<0.001). Consequently, more postmenopausal women were in the high risk category (both, P<0.05). Even though mean TG was similar in pre and postmenopausal women, significantly more postmenopausal women were in the high risk category (29% versus 25%, P<0.0005). Multiple linear regression analysis showed that EI was the strongest predictor for BMI and WC (both P<0.0005). WC was an independent predictor of fasting blood sugar (P<0.0005) and TC (P<0.01) whilst BMI showed the strongest influence on glucose tolerance (P<0.0005). The findings indicated a plausible interaction of EI on BMI and WC with subsequent impact on glucose homeostasis and TC (Table 7). Based on the KAP (Table 8), two fifths (43%) were knowledgeable of the food pyramid with more premenopausal women giving correct answers, 50% versus 35% postmenopausal. The majority knew of ways to obtain the necessary nutrients (Q2, 89%) and calcium rich foods (Q12, 81%), which was important for

Table 5. Anthropometric measurements and body mass index of participants

Anthropometric measurements	All	Premenopause	Postmenopause
	Mean±SD	Mean±SD	Mean±SD
Weight (kg)*	59.67±9.02	60.58±9.57	58.43±8.08
Height (m)	1.55±0.05	1.55±0.05	1.55±0.06
Waist circumference (cm)	79.53±8.12	79.47±8.42	76.61±8.24
Hip circumference (cm)	97.38±8.12	97.71±8.64	96.93±7.33
Body mass index (kg/m^2)	24.89±3.89	25.13±4.11	24.52±3.55
BMI classification* [21]	%	%	%
Below normal (<18.5)	12 (3.3)	6 (2.9)	6 (3.9)
Normal (≥18.5-25.0)	192 (53.3)	99 (47.8)	93 (60.8)
Overweight (>25.0-29.9)	122 (33.9)	81 (39.1)	41 (26.8)
Obese I (≥30.0-34.9)	30 (8.3)	18 (8.7)	12 (7.8)
Obese II (≥35.0-39.9)	2 (0.6)	1 (0.5)	1 (0.7)
Obese III (≥40.0)	2 (0.6)	2 (1.0)	-

*P<0.05

Table 6. Haemoglobin, blood sugar and lipid profile of participants

	All	Premenopause	Postmenopause
Biochemical variables	Mean±SD	Mean±SD	Mean±SD
Haemoglobin (g/dL)¶	12.78±1.24	12.55±1.43	13.09±0.83
Fasting blood sugar (mmol/L)	5.35±1.14	5.23±1.05	5.43±1.26
2 hour post prandial (mmol/L)	6.61±2.79	6.57±2.80	6.67±2.78
TC (mmol/L)#	5.76±0.96	5.59±0.99	6.00±0.86
HDL-C (mmol/L)	1.53±0.34	1.52±0.33	1.55±0.35
LDL-C (mmol/L)#	3.70±0.93	3.53±0.92	3.93±0.90
TG (mmol/L)	1.20±0.62	1.20±0.70	1.21±0.51
Risks category	N (%)	N (%)	N (%)
Haemoglobin status# [22]			
Hb <12	67 (18.9)	53 (26.1)	14 (9.2)
Hb ≥12	288 (81.1)	150 (73.9)	138 (90.8)
Fasting blood sugar [23]			
Normal (<6.1)	325 (90.8)	191 (92.7)	134 (88.2)
Impaired (≥6.1-<7.0)	17 (4.7)	5 (2.4)	12 (7.9)
Diabetic (≥7.0)	16 (4.5)	10 (4.9)	6 (3.9)
2 hours post prandial			
Normal (<7.8)	286 (79.9)	167 (81.0)	119 (78.3)
Impaired (≥7.8-<11.1)	56 (15.6)	30 (14.6)	26 (17.1)
Diabetic (≥11.1)	16 (4.5)	9 (4.4)	7 (4.6)
TC * [24]			
Normal	98 (27.8)	66 (32.7)	32 (21.3)
Borderline	138 (39.2)	78 (38.6)	60 (40.0)
High	116 (33.0)	58 (28.7)	58 (38.7)
LDL-cholesterol*			
Normal	135 (38.4)	90 (44.6)	45 (30.0)
Borderline	105 (29.8)	58 (28.7)	47 (31.3)
High	112 (31.8)	54 (26.7)	58 (38.7)
HDL-cholesterol			
Normal	349 (99.2)	201 (99.5)	148 (98.7)
Low	3 (0.8)	1 (0.5)	2 (1.3)
TG§			
Normal	258 (73.3)	152 (75.2)	106 (70.7)
High	94 (26.7)	50 (24.8)	44 (29.3)

*P<0.05; ¶ P <0.01; # P <0.001; § P <0.0005

prevention of osteoporosis. Most were knowledgeable of cooking methods that increased fat content (Q14, 89%), dangers of excess caloric intake (Q15, 82%), risk of diseases from obesity (Q16, 86%), dangers of excess sugar intake (Q18, 86%) and risk of poor calcium intake (Q19, 90%). Nevertheless, other aspects of nutritional knowledge were poor as only 11% and 18% correctly identified the most eaten food group (Q3) and the food group that provided the most energy (Q5). A third of all women correctly answered Q11, foods that contained the most cholesterol and the use of body mass index (Q20) in weight control. Overall, two fifths (39%) had high knowledge scores (=/>75%), more among the premenopausal (43%) than the postmenopausal (33%). A fifth (20%) had poor scores (<50%), 18% premenopausal versus 22% post-menopausal with no significant differences seen in

Table 7. Association of energy or nutrient intake to other variables

Dependent variable	Independent variable	Strongest predictor	F value
Body Mass Index	Energy intake, carbohydrate, protein, fat.	Energy intake	53.923**
Waist circumference	Energy intake, carbohydrate, protein, fat	Energy intake	27.476**
Fasting blood sugar	Energy intake, carbohydrate, protein, fat, BMI, waist circumference	Waist circumference	23.816**
Glucose tolerance	Energy intake, carbohydrate, protein, fat, BMI, waist circumference	BMI	22.267**
Total serum cholesterol	Energy intake, carbohydrate, protein, fat , BMI, waist circumference	Waist circumference	7.657*

* P<0.01; ** P<0.0005

Table 8. Knowledge of the food pyramid among all subjects

N = 360	Correct answers (%)		
Knowledge items	All	Premenopause	Postmenopause
1. Nutrients required for a balance diet	64.2	66.7	60.8
2. The ways to obtain the necessary nutrients	89.4	89.4	89.5
3. The most eaten food group according to the food pyramid	11.4	13.5	8.5
4. The least eaten food group according to the food pyramid	39.4	44.0	33.3
5. The type of nutrients that provide the most energy (cal)	17.8	14.0	22.9
6. The type of nutrients for body building	53.6	58.0	47.7
7. Foods that contain the most carbohydrate	62.8	71.5	51.0
8. Foods that contain the most protein	53.9	54.1	53.6
9. Foods that are rich in vitamins, mineral and fiber	62.2	66.2	56.9
10. Foods with the highest fiber content	80.0	81.2	78.4
11. Foods with the highest cholesterol content	36.9	38.6	34.6
12. Foods that are rich in calcium	81.1	84.1	77.1
13. Foods with high salt content	65.0	68.1	60.8
14. The ways of cooking that will increase fat content	89.2	92.3	85.0
15. The outcome of excessive caloric intake	81.9	85.5	77.1
16. The risk of disease caused by obesity	90.0	88.4	92.2
17. To avoid obesity and to maintain an ideal weight, we must balance food intake with :	75.8	74.4	77.8
18. The risk of excessive sugar intake	85.8	83.6	88.9
19. The risk of poor calcium intake	90.3	89.9	90.8

the various score categories. Poorer knowledge among post-menopausal women could be due to the higher proportion of less educated subjects with low literacy. The majority (86%) of participants cited newspapers and magazines as the primary source of information when asked to rank the sources of information from which they obtained nutritional knowledge. Their social circle of family, friends and neighbours was the second most common source, followed by television (Table 9).

Lifestyle practices demonstrated good correlation to educational level and knowledge scores (Table 10). Women who exercised regularly had significantly better nutritional knowledge and also tended to practice food supplementation (both P <0.05). In addition, vitamins and mineral supplementation was positively associated to educational status (P <0.005) and nutritional knowledge (P <0.05).

The association between education and nutritional know-ledge may account for the higher proportion of pre-menopausal women who practiced food and vitamin supplementation compared to the postmenopausal in the study. Knowledge scores demonstrated a strong positive relationship to educational level and household income i.e. socio-economic status (both P <0.005). A high level of knowledge was also linked to intake of calcium supplements and lower TC (both P <0.05). The findings suggested that women of higher income and education had better nutritional knowledge, which probably led to

Table 9. Sources of information for nutritional and dietary knowledge

Source	% (frequency)
Newspapers/magazines (N=360)	85.8 (309)
Friends/family members/neighbours (N =360)	61.4 (221)
Television (N =360)	59.2 (213)
Radio (N =360)	42.5 (153)
Doctors/nurses (N =360)	33.9 (122)
Others e.g. *Internet, books* (N=360)	6.7 (24)

more informed choices on food and lifestyle practices which in turn led to a better health status i.e. lower TC.

Discussion

The results of this study were not reflective of middle-aged Malaysian women in general, but an urban community with higher income and better education. The recruitment process had contributed to this bias as women who were highly motivated and health conscious would have volunteered to participate in this study. They would have already possessed a better health status, lower risk factors for development of diseases and be more compliant to intervention or advice. As expected, the women sampled had a satisfactory diet and healthy lifestyle i.e. 62% exercised regularly with 1% being smokers and 9% drank alcohol regularly. Alcohol was forbidden to Islamic practitioners, mainly Malays, which may also account for the overall low intake. Although not representative of the general population, the study included all major ethnic groups with a comparable urban distribution ratio. In contrast, previous studies had focused on nutrition and health in rural communities, a single ethnic group or industry. Consequently, the data from this fairly large study would provide a useful reference for future research into the subject.

Table 10. The association between knowledge scores, lifestyle factors and other parameters

Parameters	Statistical outcome
Exercise versus	
Educational level	χ^2 =7.510
Household income	χ^2 =3.708
Nutritional knowledge level	χ^2 =8.558*
Calcium supplementation	χ^2 =0.945
Food supplementation	χ^2 =4.965*
Vitamins and mineral supplementation	
Educational level	χ^2 =20.239**
Nutritional knowledge level	χ^2 =7.358*
Knowledge scores	
Educational level	χ^2 = 71.052**
Household income	χ^2 = 28.361**
Total serum cholesterol	r = -0.133*
Dietary calcium intake	r = 0.199**

* P<0.05; **P<0.005

Food frequency assessment revealed that the overall diet was satisfactory. Rice was the staple food with fish and vegetables being consumed almost daily by the majority of subjects. A three meal pattern of breakfast, lunch and dinner was practiced by the majority. Food choices were comparable to a report of middle-aged Malay adults[10] and were healthier than a female population of electronic factory workers who had eggs as the main protein source followed by chicken and fish with a lower consumption of fresh fruits and vegetables. The cost of healthy foods was cited as the main obstacle to consuming them.[31] The findings showed that EI consisted of 53% carbohydrates, 15% protein and 32% fats with carbohydrate and protein intake within the WHO recommendations.[25] The estimated mean EI was 11% below RDA, similar to previous studies.[26-28] The study subjects had EI comparable to urban post-menopausal Chinese [29] but higher than rural adult women.[30]

Based on the EI/BMR ratio,[20] FFQ estimation for majority were within normal with EI showing positive correlation to BMI (r=0.364, P<0.05). The proportion of low energy reporters was only 13.5%, less than other studies.[32,33] This may be partly explained by the fact that a blood sample was taken at the same time as the FFQ was administered, leading subjects to presume that nutrient intake was also being assessed via blood profile and therefore making subjects more cooperative with diet recall.[34] EI reduced with age, an observation consistent with local studies as well as other elderly populations.[26,35,36] Protein estimation was above 100% RDA as low quality protein from sources such as rice, a food staple, was factored in as well.[28,35,36] A fat intake of 32% was higher than previously reported (26% and 30% for local adult women)[28,37,38] and higher than the WHO recommendation of 30% for prevention of chronic diseases.[25] Fruit and vegetable intakes were very high leading to an estimation of vitamin C, 3.5 fold above RDA. The estimated value, however, was consistent with other studies.[28,35]

The study population on the whole had inadequate iron intake, reaching 72% RDA. The deficit was mainly among the premenopausal with an iron intake 56% RDA, contributing to a higher occurrence of iron deficient anaemia. Exacerbating the occurrence of anaemia in some women would be irregular heavy bleeding due to hormonal changes in the climacteric phase.[39] In post-menopausal women, absence of cyclic bleeding minimised the loss of iron, reducing the risk of anaemia. The intake of iron also showed a negative trend with age implying a deterioration in nutritional intake as women grew older.[26]

Dietary calcium was estimated to reach 440mg daily, 98% RDA, comparable to other reports.[29,35,40] Dairy products were not the major source of dietary calcium with daily milk intake reported by a third while a minority of subjects, 5% had cheese and yogurt on a daily basis. The current level of dietary calcium was deemed insufficient by the Consensus Conference on Optimal Calcium Intake[41] which recommend 1500mg for prevention of osteoporosis among the postmenopausal. Half of the women in this study took calcium supplements demonstrating an awareness of osteoporosis prevention. Nevertheless, further efforts are needed to increase calcium intake among those postmenopausal as additional calcium had been shown to improve bone mass density in osteopenic and osteoporotic postmenopausal women with low habitual intake, <400mg per day.[42] A third of all subjects in this study were dyslipidemic and 5% diabetic, mirroring the trend in the general population.[10] The current population prevalence of diabetes mellitus was 8.2%,[1] a fourfold increase from 2% in 1985.[43] Hyperlipidemia was found in two fifths of a rural Malay community and evaluation using the global risk assessment indicator showed that 32% were at high risk for cardiovascular heart disease.[44] Urbanites may have higher risks as a smaller study showed 84% pre and postmenopausal women had high serum cholesterol.[45]

In this study, postmenopausal women were leaner, ate less dietary fat and did more exercise compared to the premenopausal. A lower dietary fat intake was probably the result of lower meat intake as a fifth of postmenopausal women were none meat eaters. A consistent observation was made by Appleby *et al*.,[46] that mean BMI was lower in non meat eaters than meat eaters, an effect mediated by higher dietary fiber intake and lower animal fat intake in the non meat eaters.[47] The fat content of diet was shown to affect body fat as a function of dietary fat on EI whereby lowering the fat content of diet also reduces EI.

A cause and effect relationship was observed in this study whereby EI had a positive impact on BMI and WC, an association observed in other populations.[48-51] WC was an independent predictor of fasting blood sugar and TC whereas BMI was a significant factor on glucose tolerance. The findings indicated a plausible interaction of EI on BMI and WC with subsequent impact on glucose homeostasis and TC, an observation reinforced by the association between WC and metabolic risk factors.[52] While the postmenopausal were not deemed at risk of cardiovascular disease (CVD), they had riskier lipid profiles with higher TC which had arisen solely from an increased LDL-C. The findings indicated that the deterioration of the lipid profile was probably due to the consequence of intrinsic changes associated with the climacteric transition and general aging [53-55] rather than changes in lifestyle and diet, as both aspects were comparable between pre and postmenopausal women.

Our results indicated that over-nutrition is a growing problem in the urban population; borne out by the higher prevalence of obesity amongst the younger premenopausal subjects whereas older postmenopausal women were leaner, an observation seen in other studies.[10,56] In time, this cohort of premenopausal women will reach menopause, along with potentially higher risks of developing morbid conditions. Of the three independent and significant factors impairing lipoprotein profiles i.e. menopause, age and increased weight, only obesity was modifiable by lifestyle changes.[57] Hence, local women should be advised to reduce caloric intake in order to maintain the ideal body weight, in lieu of a 2% reduction of BMR for every decade after the age of twenty.[58] The reduction in caloric intake needs to be balanced against a substandard diet poor in calcium and iron - two minerals that were found to be insufficient in this study.

The level of nutritional knowledge demonstrated by the study sample was higher than other local reports[31,59] although the scores were not comparable. Poorer knowledge observed among postmenopausal women could be due to the higher proportion of less educated subjects with low literacy, who could not understand or use health information, or communicate well.[60] Higher nutritional knowledge was related to socio-economic status of education and household income. Education and income, in addition to gender, cultural and psychological variables were important factors influencing nutrition knowledge and food practices in other populations.[61,62] Education had been correlated with increased knowledge of risk factors and a greater perception of control over the environment and lifestyle and thus a sense of better risk control.[63]

The study showed that subjects who participated in regular exercise had higher nutritional knowledge scores[64-66] and those who took supplements were more highly educated, similar to findings by other investigators.[67,68] Nutritional knowledge demonstrated a significant inverse association to TC and a positive relationship to supplementary calcium intake; suggesting that nutritional knowledge had a direct impact on health and health maintenance. In certain high risk populations, acquired nutritional knowledge encouraged a positive attitude and practice with concomitant reduction in risk of developing chronic conditions.[69-71] Reading materials such as magazines and newspapers were the main sources of information regarding food and nutrition for women in this sample, a finding reported by many authors. Nutritional knowledge could be taught and efficiently assimilated in a short period compared to changes in attitude and practice,[72-74] making it an appropriate target to initiate improvement. Therefore, a call must be made for newspapers and magazines to give food and nutritional knowledge prominence in their publications to help educate more readers towards better food and nutritional practices.

In conclusion, urban Malaysian women above 45 years of age had a satisfactory diet and healthy lifestyle. Total energy intake was 11.5% below Malaysian RDA, consisting of 53% carbohydrates, 15% protein and 32% fat. Iron intake was deficient, reaching 56% RDA in premenopausal women while calcium intake reached 440mg daily, but dairy products were not the main source. More premenopausal women (49%) were overweight or obese compared to the postmenopausal (35%) and the former consumed more dietary fat (6%). EI was the strongest predictor for BMI and WC, with WC itself an independent predictor of fasting blood sugar and TC while BMI had the strongest influence on glucose tolerance. Postmenopausal women had a more artherogenic lipid profile with significantly higher levels of TC and LDL-C than the premenopausal. Comparable nutrient intakes and lifestyles between pre and postmenopausal women suggested that health changes associated with menopause were mostly independent of diet.

Knowledge scores demonstrated a strong positive relationship to educational level and household income, lifestyle practices and TC. In turn, lifestyle practices of regular physical activity and vitamin/mineral supplementation demonstrated good correlation to educational level and knowledge scores. Newspapers and magazines followed by the social circle were the main sources of nutritional information. To summarise, women of higher income and education had better nutritional knowledge which contributed to more informed food choices and lifestyle practices which in turn led to a better health status.

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References

1. Ministry of Health Malaysia, Statistics 2004. http://www.moh.gov.my/ (June 2005)
2. Calle EE, Thun MJ, Petrelli JM, Rodriguez C, Heath CW Jr. Body-mass index and mortality in a prospective cohort of U.S. adults. N Engl J Med 1999; 341: 1097-1105.
3. Ismail MN, Chee SS, Nawawi H, Yusoff K, Lim TO, James WP. Obesity in Malaysia.Obes Rev 2002;3:203-208.
4. Ng TKW, Tee ES, Azriman R. Rural communities in nutritional transition:emergence of obesity, hypertension and hypercholesteronemia as public health problems in three kampungs in Bagan Datoh, Perak. Mal J Nutr 1995; 1: 129-139.
5. Ng TKW, Khor GL, Tee ES, Normah H. Nutritional assessment of rural villages and estates in Peninsular Malaysia: total blood cholesterol values in children, adolescent and adults. Asia Pac J Clin Nutr 2000. 9:115-121.
6. Norimah AK, Leung SW. Evaluation of nutritional status among a group of young Chinese adults in Kuala Lumpur. Asia Pac J Clin Nutr 2000; 9: 82-86.
7. Suzana S, Dixon RA, Earland J. Development of a screening tool for detecting undernutrition and dietary inadequacy among rural elderly in Malaysia: simple indices to identify individuals at risk. Int J Food Sci 1999; 50: 453-444.
8. Suzana S, Earland J, Suriah AR. Food intakes and habits of rural elderly Malays. Asia Pac J Clin Nutr 2000; 9:122-129.
9. Suzana S, Earland J, Suriah AR. Social and health profile of rural elderly Malays. Singapore Med J 2001; 42:208-213
10. Norimah AK, Kather HMM. Nutritional status and food habits of middle aged adults in selected areas of Selangor. Mal J Nutr 2003; 9: 125-136.
11. World Bank. 1991. Asia region population projections, 1990-1991 edition. Working papers WP5999. Washington: Department of Population and Human Resources.
12. Dept of Statistics Malaysia, 2001. Census 2000. http://www. statistics.gov.my (December 2001)
13. Tan PC. Social and economic security needs of older women in Asia. In Bulletin on Aging. Dept for Policy Coordination and Sustainable Development, United Nation, New York, 1995.
14. Pon LW. Effectiveness of healthy lifestyle and hormonal replacement therapy (HRT) on nutritional and health status of women aged 45 and above. Masters Medical Science, Universiti Kebangsaan Malaysia, 2002.
15. Norimah AK. Development of dietary assessment methods for use in the South Asian community. PhD Thesis. University of Southhampton, 1997.
16. Norimah AK, Margetts BM. Calibration of a food frequency questionnaire developed for the South Asian community in the United Kingdom. Mal J Nutr 1997; 3:49-60.
17. Maisarah H. Kajian kalibrasi soal-selidik kekerapan makanan dengan merekod diet dikalangan komuniti Melayu di Lembah Kelang. BSc Thesis. Universiti Kebangsaan Malaysia, 1999.
18. Tee ES, Mohd-Ismail N, Mohd-Nasir A, Khatijah I. Nutrient composition of Malaysian foods (4th Edition). 1997. Malaysian Food Composition Database Programme c/o Institute for Medical Research, Kuala Lumpur.
19. Teoh ST. Recommended daily dietary intakes for Peninsular Malaysia. Med J Malaysia 1975; 30: 38- 42.
20. Ismail MN, Wan-Nudri WD, Zawiah H. Energy expenditure studies to predict requirements of selected national athletes. Mal J Nutr 1997; 3: 71-81.
21. World Health Organization. Physical Status: The use and interpretation of anthropometry. Technical Report Series No. 854. Geneva, WHO, 1995.
22. WHO/UNICEF/UNU. IDA: Prevention, assessment and control. 1998. Report of a joint WHO/UNICEF /UNU consultation, Geneva. Geneva, WHO.
23. World Health Organization. Diabetes and non-communicable disease risk factor surveys: a field survey guide text. WHO/NCD/NCS/99.1. Geneva WHO, 1999.
24. NCEP-Executive summary of the third report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of high blood cholesterol in adults (Adults Treatment Panel III). JAMA 2001; 285: 2486-2497.
25. World Health Organization. Diet, nutrition, and the prevention of chronic diseases. Technical Report Series No. 797. Geneva, WHO, 1990.
26. Suriah AR, Zainorni MJ, Shafawi S, Suraya, MS, Zarina N, Wan-Zainuddin WA, Zalifah MK. Nutrient intake among elderly in southern Peninsular Malaysia. Mal J Nutr 1996; 2: 11-19.
27. Chee SS, Zawiah H, Ismail MN, Ng KK. Anthropometry, dietary patterns, and nutrient intake of Malaysian estate workers. Mal J Nutr 1996; 2: 122-126.
28. Chee SS, Ismail MN, Ng KK, Zawiah H. Food intake assessment of adults in rural and urban areas from four selected regions in Malaysia. Mal J Nutr 1997; 3: 91-102.
29. Chee WSS, Suriah AR, Zaitun Y, Chan SP, Yap SL, Chan YM. Dietary calcium intake in postmenopausal Malaysian women: comparison between the food frequency questionnaire and three-day food records. Asia Pac J Clin Nutr 2002; 11: 142-146.
30. Khor GL, Zalilah MS. Dual forms of malnutrition in the same households in Malaysia – a case study among Malay rural households. Asia Pac J Clin Nutr 2003; 12: 427-438.
31. Lim HM, Chee HL, Kandiah M, Shamsuddin K, Jamaluddin J, Nor Anita MMN, Shuib R. Dietary and other factors associated with overweight among women factory workers in two electronic factories in Selangor. Mal J Nutr 2003; 9: 105-124.
32. Cook A, Pryer J, Shetty P. The problem of accuracy in dietary surveys. Analysis of the over 65 UK National Diet and Nutrition Survey. J Epidemiol Comm Healt 2000; 54: 611-616.
33. Westerterp KR, Goris AHC. Validity of the assessment of dietary intake: problems of misreporting. Clin Nutr Metab Care 2002; 5: 489-493.
34. Willett W. Food frequency methods. In Nutritional Epidemiology, 2nd Edition. Oxford University Press, New York, 1998; 74-94.
35. Shahar S, Earland J, Rahman SA. Food intake and habits of rural elderly Malays. Asia Pac J Clin Nutr 2000; 9: 122-129.
36. Energy intake. In Report on health and social subjects no 41. Dietary reference values for food energy and nutrients for United Kingdom. Dept of Health. Crown, copyright 1991; 15-39.
37. Fatimah A, Md-Idris M.N, Romzi MA, Faizah H. Energy, protein, fat, and CHO intake of underweight, normal weight, and obese government office workers in an urban area. Asia Pac J Clin Nutr 1996; 5: 88-91.
38. Ng TKW. Towards improved fat intake and nutrition for Malaysians. Mal J Nutr 1995; 1: 21-30.

39. McKinlay, SM. The normal menopause transition: an overview. Maturitas 1996; 23: 137-145.
40. Foo LH, Zaitun Y. Perkaitan di antara pengambilan kalsium dan factor-faktor gaya hidup dengan status kesihatan tulang di kalangan wanita selepas menopause. Mal J Nutr 2000; 6: 75- 95.
41. NIH (National Health Institute). Consensus Conference on Optimal Calcium Intake. NIH Consensus Development Panel on Optimal Calcium Intake. JAMA 1994; 212: 1942-1948.
42. New SA. Bone health: the role of micronutrients. Br Med Bull 1999; 55: 619-33.
43. Mustaffa BE. Diabetes mellitus in peninsular Malaysia: ethnic differences in prevalence and complications. Ann Acad Med Singapore 1985; 14: 272-276.
44. Nawawi HM, Nor IM, Noor IM, Karim NA, Arshad F, Khan R, Yusoff K. Current status of coronary risk factors among rural Malays in Malaysia. J Cardiovasc Risk 2002; 9: 17-23.
45. Damodaran, P, Subramaniam R, Omar SZ, Nadkarni P, Paramsothy M. Profile of a menopause clinic in an urban population in Malaysia. Singapore Med J 2000; 41: 431-435.
46. Appleby PN, Thorogood M, Mann JI, Key TJ. Low BMI in non meat eaters; possible roles of animal fats, dietary fibers and alcohol. Int J Obes 1998; 22: 454-60.
47. Key TJ, Davey GK. Prevalence of obesity is low in people who do not eat meat. BMJ 1996; 313: 816-17.
48. Popkin BM, Paeratakul S, Zhai F, Ge K. Dietary and environmental correlates of obesity in a population study in China. Obes Res 1995; 3 (Suppl): 135s-143s.
49. Heitmann BL, Lissner L, Sorensen TI, Bengtsson C. Dietary fat intake and weight gain in women genetically predisposed for obesity. Am J Clin Nutr 1995; 61:1213-7.
50. Bolton-Smith C, Woodward M. Dietary composition and fat to sugar ratios in relation to obesity. Int J Obes Relat Metab Disord 1994; 18:820-8.
51. Stookey JD, Adair LS, Popkin BM. Do protein and energy intakes explain long-term changes in body composition? J Nutr Health Aging 2005. 9:5-17.
52. Lear SA, Chen MM, Frohlich JJ, Birmingham CL. The relationship between waist circumference and metabolic risk factors: cohorts of European and Chinese descent. Metabolism 2002; 51:1427-32.
53. Stevenson JC, Crook D, Godsland IF. Influence of age and menopause in serum lipids and lipoproteins in healthy women. Atherosclerosis 1993; 98: 83-90.
54. Kuller, LH, Gutai JP, Meilahn E, Matthews KA, Plantinga P. Relationship of endogenous sex steroid hormones to lipids and apoproteins in postmenopausal women. Arteriosclerosis 1990; 10: 1058-1066.
55. Bush TL. The epidemiology of cardiovascular diseases in postmenopausal women. Ann. NY Acad. Sci. 1990. 592: 263-271.
56. Lim TO, Ding MHA, Suleiman AB, Kew ST, Maimunah AH, Rozita H, Rashid A. Distribution of blood glucose in a national sample of Malaysian adults. Med J Mal 2000; 55: 65-77.
57. Berg G, Mesch V, Boero L, Sayegh F, Prada M, Royer M, Muzzio ML, Schreier L, Siseles N, Benencia H. Lipid and lipoprotein profile in menopausal transition. Effect of hormones, age and fat distribution. Horm Metab Res 2004;. 36: 215-220.
58. Wing RR, Matthews KA, Kuller LH, Meilahn EN, Plantinga PL. Weight gain at the time of menopause. Arch Intern Med 1991; 151: 97-102.
59. Ruzita AT, Rasyedah AR. Penerimaan masyarakat terhadap bahan pendidikan pemakanan bercetak. Mal J Nutr 2001; 7: 51-60
60. Eng TR, Maxfield A, Patrick K, Deering MJ, Ratzan SC, Gustafson DH. Access to health information and support: a public highway or a private road. JAMA 1998; 280: 1371-1375.
61. Parmenter K, Waller J, Wardle J. Demographic variation in nutrition knowledge in England. Health Educ Res 2000; 15: 163-174.
62. Worsley A. Nutrition knowledge and food consumption: can nutrition knowledge change food behaviour? Asia Pac J Clin Nutr 2002; 11(suppl): S579-S585
63. Naimark BJ, Tate RB, Turner DM. Assessing women's knowledge, behaviour and information needs about coronary heart disease. J Nursing Scholar 1999; 31:95-101.
64. Schmitz K, French SA, Jeffrey RW. Correlates of changes in leisure time physical activity over 2 years: The Healthy Worker Project. Prev Med 1997; 26: 570-579.
65. Lian WM, Goh LG, Pin CH, Wee S, Ye HC. Correlates of leisure-time physical activity in an elderly population in Singapore. Am J Public Health 1999; 89: 1578-1580.
66. Sternfeld B, Ainsworth BE, Quesenberry CP. Physical activity patterns in a diverse population of women. Prev Med 1999; 28: 313-323.
67. Lyle BJ, Mares-Perlman JA, Klein BE, Klein R, Greger JL. Supplement users differ from nonusers in demographic, lifestyle, dietary and health characteristics. J Nutr 1998; 128 (12): 2355-2362.
68. Levy AS, Schucker RE. Patterns of nutrient intake among dietary supplement users: attitudinal and behavioral correlates. J Am Diet Assoc 1987; 87: 754-760.
69. Brunner E, White IR, Thorogood M, Bristow A, Curle D, Marmot MG. Can dietary intervention change diet and cardiovascular risk factors. Am J Public Health 1997; 87; 1415-1422.
70. Shewry MC, Smith WCS, Tunstall-Pedoe H. Health knowledge and behaviour change: a comparison of Edinburgh and North Glasgow. Health Educ J 1990; 49:185-190.
71. Plaisted CS, Lin PH, Ard JD, McClure ML, Svetkey LP. The effects of dietary patterns on quality of life: a substudy of the Dietary Approaches to Stop Hypertension trial. J Am Diet Assoc 1999; 99 (suppl 8): S84-S94.
72. Krinke UB. Nutrition information topic and format preferences of older adults. J Nutr Educ 1990;22: 292-297.
73. Zaitun Y, Low TS. Assessment of nutrition education needs among a sample of elderly Chinese in an urban area. Mal J Nutr 1995; 1: 41-50.
74. Almeida MDV, Graca P, Lappalainen R, Giachetti I, Kafatos A, Winter AMR, Kearney JM. Sources used and trusted by nationally-representative adults in the European Union for the information on healthy eating. Eur J Clin Nutr 1987; 51 (suppl): 16S-22S.

Original Article

Diet, nutritional knowledge and health status of urban middle-aged Malaysian women

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马来西亚城市中年妇女的饮食、营养知识和健康状况

此研究的目的是评价马来西亚城市中年妇女的营养，健康状况和营养知识。更年期对饮食和健康指数的影响也在研究之例。本研究包括 360 位无疾病妇女，不使用激素代替治疗（HRT），年龄≥4 5 岁并从 1999 年 11 月至 2001 年 10 月恢复完整的子宫。个人特征，人体测量和血样的获得遵照临床检查。营养素的摄入和营养知识测定通过定量的食物频度问卷（FFQ）调查和知识、行为、态度（KAP）调查。检查结果显示 51.65±5.40 岁的城市中年妇女，能量摄入（EI）11%低于每日平均推荐量（RDA），由 53%碳水化合物，15%蛋白质和 32%脂肪组成并随着年龄下降。受试人群中包括 42.5%更年期后的妇女有令人满意的饮食和健康的生活方式。更年期前的妇女比更年期后的妇女通过另外的饮食消耗更多的膳食脂肪(6%)。更年期前的妇女缺乏铁的摄入，占 56%的 RDA，促成了 26%贫血患病率。全部钙的摄入量达到了每天 440mg，但是乳制品不是主要的来源。更年期前的妇女有更高血管硬化作用的脂肪剖面，和显著性地高总胆固醇和 LDL-C 水平，但是更多的更年期前的妇女是超重/肥胖的(49%比 35%)。EI 是强有力的 BMI 和腰围的预测器，腰围是一个独立的空腹血糖预测器，而 TC 和 BMI 强烈地影响葡萄糖耐糖量。39% 的妇女有高营养知识，而 20%的妇女营养知识贫乏。报纸和杂志，还有患者的社交圈是主要的营养信息来源。营养知识和教育，家庭收入，维生素/矿物质增补剂和有规律的身体锻炼成正相关，但和 TC 负相关。结论，城市中年妇女有一个低铁和钙的饮食。营养知识和更健康的生活方式实施和更低 TC 正向关系。通过对更年期前后妇女营养素和生活方式的比较，建议与更年期相关的健康状态的变化在很大程度上是不依赖饮食。

关键词：食物频率、更年期、知识、健康、中年、妇女、城市、马来西亚。