

## Original Article

# Food intakes and habits of rural elderly Malays

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A cross-sectional nutritional survey was carried out on 350 elderly Malays aged 60 and above from 11 randomly selected villages in a rural area on the east coast of Malaysia. The findings indicated that the mean intakes of energy and of all of the nutrients investigated were below the Malaysian Recommended Dietary Allowances, except for protein and vitamin C. With respect to dietary habits, almost all of the subjects reported that they had breakfast (99.3%), lunch (97.9%) and dinner (90.4%) daily or almost daily (5–6 times/week). However, approximately half of the subjects, especially women, had particular beliefs and prohibitions about specific foods. Most of the subjects usually ate their meals at home, particularly dinner, with 99.3% always having dinner in their own home. Thus, although the rural elderly Malays studied had regular meal intakes, the dietary intake was inadequate. There is a need to plan community-based intervention programmes in order to prevent the subsequent consequences of malnutrition that lead to increased morbidity and mortality.

**Keywords:** dietary habits, elderly, food intakes.

## Introduction

Malaysia is experiencing a demographic transition, one outcome of which is an increase in the number and proportion of elderly in the population.<sup>1</sup> This has raised concern on the nutritional needs of elderly people<sup>2</sup> given that various socio-economic, physiological and psychological factors make them particularly liable to have poor diets and to be at risk of undernutrition.<sup>3</sup> A large proportion of rural Malays' children are undernourished.<sup>4,5</sup> Thus, elderly people residing in a similar environmental situation (that is, a lower socioeconomic status and lack of health facilities) are also vulnerable to malnutrition or undernutrition. A review of the reports from the few small-scale cross-sectional studies in developing countries revealed that a large number of older people in these regions are undernourished and that their dietary intakes are inadequate.<sup>6</sup> Unfortunately, the few reported studies among the rural elderly population (exclusively Malays) only used a small sample size and a 24-h dietary recall.<sup>7</sup> The 24-h dietary recall, which has been the most frequently used method to assess nutrient intakes by other investigators in the Asian region,<sup>8–10</sup> provides satisfactory estimations for the mean dietary intake of groups. However, it does not provide reliable estimates of usual intake for an individual for many nutrients.<sup>11</sup> Although anthropometry and biochemical methods have been widely accepted as an objective assessment of nutritional status, data on dietary intakes and food habits can provide a better understanding of overnutrition and undernutrition.

In spite of the existence of data on adequacy of intakes, little is known about the food habits of the elderly, particularly in Malaysia. Recognising the vulnerability of elderly people and the lack of data, this study aimed to assess the food intakes and preferences through a validated dietary method. This study is part of a larger nutritional and health

survey among rural elderly Malays.<sup>6,12,13</sup> This study was conducted in accordance with the internationally agreed ethical principles for the conduct of medical research.

## Methods

### Sampling

This study was carried out in rural areas of Mersing district on the east coast of Malaysia, 300 km from Kuala Lumpur. Eleven traditional villages were randomly selected from the list of 62 held by the district office. These 11 villages reflected the major economic activities of the rural population (fishing, farming, rubber tapping and being employed as estate labourers). All elderly people aged 60 years and above and permanent residents (that is, of at least 12 months) in the selected villages were invited to participate at their respective community centres. Individual consent was obtained.

### Data collection

Data were collected at the respective community centres in August 1995. Trained interviewers probed data on usual food intakes using a validated dietary history questionnaire with a food frequency checklist. The dietary history questionnaire (DHQ) was validated against a 7-d weighed intake (WI) in a subsample of 37 elderly people residing in the study area. Results indicated that the medians of intakes from the two methods were rather similar and varied less than 30% for

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every nutrient, except for vitamin C (114%). Analysis of group means using the Wilcoxon rank sum test showed no significant difference between the estimation of intakes from the DHQ and from the WI, with the exceptions of vitamin C and niacin. The DHQ was modified by adding a checklist of major sources of niacin, such as meat and cereal products, as well as sources of fruits and vegetables to the food frequency checklist in order to increase the accuracy of the reported intake. Information on social and health aspects and also food habits, including food beliefs, meal times and preferences of cooking methods, were also collected. Anthropometric measurements such as weight and height were also collected in order to compute body mass index (BMI).<sup>12</sup> The rainy season (November to February) and cultural and religious ceremonies were avoided in order to obtain estimates of usual dietary intakes and nutritional status. Nutrient intakes were calculated using the UK Foodbase software<sup>14</sup> supplemented by 180 Malaysian foods.<sup>15</sup>

#### Data and statistical analysis

Descriptive findings are presented as means  $\pm$  SD, median (95% CI), together with ranges. It should be noted that micronutrient intakes are related to the variability of energy intake (either high or low), which is related to differences in size, activity and metabolic efficiency.<sup>16</sup> Therefore, the micronutrient intakes were examined in relation to energy intake (per 4200 kJ) according to sex. The energy and protein intakes were also calculated in relation to bodyweight as kilojoules and grams per kg bodyweight, respectively. The intake of nutrients of each individual were compared to the Malaysian Recommended Dietary Allowances (RDA) for elderly men and women aged 60 years and above (moderately active)<sup>15</sup> in order to determine dietary adequacy. Where appropriate, the values were also compared to the World Health Organization (WHO)<sup>17,18</sup> and the UK's Committee on Medical Aspects of Food Policy recommendations.<sup>19</sup> The  $\chi^2$  test and independent sample *t*-test were used for the comparison of the data between sexes. Pearson's correlation coefficient (*r*) was computed in order to examine associations between dietary intake and age. Before this, skewed data were transformed to log (10) distribution to meet the normality assumptions of the tests.

## Results

### General findings

Out of 498 eligible subjects, 350 subjects aged 60–118 years participated (response rate of 70%). Data on 10% of the subjects were obtained from a household visit. Dietary intake were available from 337 subjects. Table 1 summarises the characteristics of the subjects. Men were more likely to be married. Women were more likely to be widowed, unemployed with no pensions and to have received no formal education. Painful joints and hypertension were the most commonly reported chronic diseases. Although the majority of the subjects had normal BMI, 38% were classified as underweight (BMI < 18.5 kg/m<sup>2</sup>).<sup>12</sup>

### Dietary intakes

The distribution of intakes of all nutrients with the exceptions for vitamin C, iron, vitamin A and calcium are normally distributed. This is probably due to the large inter- and intra-

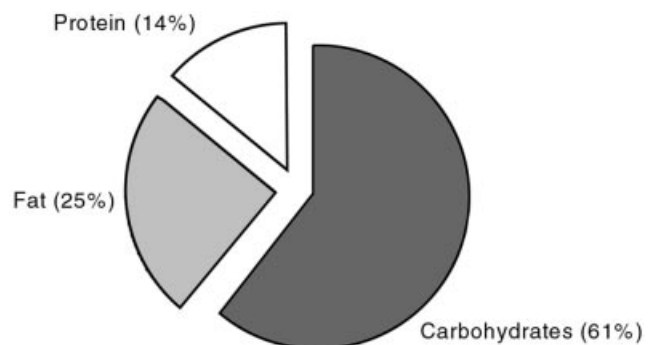
individual variations in micronutrient intakes. Therefore, they were normalised by transforming to log (10) distribution prior to analysis. The ranges of dietary energy and nutrients intakes varied widely among the subjects, as shown in Table 2.

### Macronutrients intakes

The estimated intakes of all nutrients investigated were inadequate except for protein and vitamin C (Table 2). Although men had significantly higher intakes for some nutrients (that is, energy, carbohydrate, protein, thiamine, niacin, iron), the differences were diminished after expressing the intakes in relation to weight for macronutrients or per 4200 kJ for the micronutrients (table not shown). There was a significant negative correlation between age and estimated intakes of energy ( $r = -0.1807$ ,  $P < 0.01$ ), protein ( $r = -0.1496$ ,  $P < 0.01$ ), carbohydrate ( $r = -0.1903$ ,  $P < 0.01$ ), fat ( $r = -0.1169$ ,  $P < 0.05$ ) and calcium ( $r = -0.1372$ ,  $P < 0.05$ ). A total of 125 subjects (37.1%) had energy intakes of below 5040 kJ/day, a level which is associated with an increased risk of micronutrient deficiency.<sup>20</sup> Significantly, more women (45.1%) than men (28.7%) had estimated energy intakes of below 5040 kJ/day ( $P < 0.005$ ). The energy intakes in relation to bodyweight (BW) in both men ( $118.9 \pm 39.9$  kcal/kg BW) and women ( $117.2 \pm 50.4$  kJ/kg BW) were below the WHO recommended level of 126 kcal/kg BW.<sup>17</sup> Of those interviewed, 66.5% of the women and 60.4% of the men fell into this category.

The mean intakes  $\pm$  SD of protein in relation to bodyweight in men and women were extremely similar ( $1.0 \pm 0.4$  g/kg BW). This figure was higher than the WHO recommendation of 0.8 g/kg BW.<sup>17</sup> Although the mean of intakes met the requirement (Table 2), a proportion of subjects (35.3%) had estimated protein intakes of less than 0.8 g/kg BW. The percentage of energy derived from protein of approximately 14% (Fig. 1) was within the WHO recommendation of 10–15%<sup>16</sup> and the geriatric reference range of 12–14%.<sup>21</sup>

The carbohydrate intake contributed to approximately 61% of the total energy intake in the diet (Fig. 1), which is within the UK dietary reference value (DRV)<sup>19</sup> and the WHO<sup>18</sup> recommendations that approximately 50–70% of energy should be derived from carbohydrate, of which no more than 10–11% should be from non-milk extrinsic sugars or simple sugars. Unfortunately, in this study the type of carbohydrate (that is, complex carbohydrate or simple carbohydrate) could not be assessed due to limitations of the food



**Figure 1.** Percentage of energy derived from carbohydrates, protein and fat in the diets of 337 rural elderly Malays.

**Table 1.** Social and health characteristics of the subjects

|                                     | Men (n = 172) |      | Women (n = 178) |      | Significance test <sup>a</sup> |
|-------------------------------------|---------------|------|-----------------|------|--------------------------------|
|                                     | n             | %    | n               | %    |                                |
| Married                             | 150           | 87.2 | 73              | 41.0 | <i>P</i> < 0.00001             |
| Widowed                             | 19            | 11.0 | 98              | 55.1 | <i>P</i> < 0.00001             |
| No schooling                        | 52            | 30.2 | 116             | 65.2 | <i>P</i> < 0.00001             |
| Living alone                        | 7             | 4.1  | 27              | 15.2 | <i>P</i> < 0.0005              |
| Unemployed with no pension          | 72            | 41.9 | 136             | 76.4 | <i>P</i> < 0.05                |
| Smoker                              | 103           | 59.9 | 29              | 16.3 | <i>P</i> < 0.05                |
| Had painful joints                  | 65            | 37.8 | 91              | 51.1 | <i>P</i> < 0.05                |
| Hypertension                        | 37            | 21.5 | 43              | 24.2 | NS                             |
| Prescribed medications <sup>b</sup> | 95            | 55.2 | 90              | 50.6 | NS                             |
| Food belief                         | 73            | 42.4 | 98              | 55.1 | <i>P</i> < 0.05                |

NS, non-significance; <sup>a</sup> $\chi^2$  test at 2-tailed significance; <sup>b</sup>Either daily or monthly for the past year.

**Table 2.** Descriptive findings of dietary energy and nutrient intakes among 337 rural elderly Malays

| Nutrients (unit)        | Range       | Intakes       |                     | RDA <sup>a</sup> | % of intake from RDA <sup>b</sup><br>Mean (SD) |
|-------------------------|-------------|---------------|---------------------|------------------|--|
|                         |             | Mean (SD)     | Median (95%CI)      |                  |  |
| Energy (kJ)             | 2583–13 453 | 5947 (2050)   | 5670 (5729–6170)    | 8484(M); 6720(W) | 331.8 (114.7)                                  |
| Carbohydrate (g)        | 83–512      | 224 (85)      | 212 (2 14–233)      |                  |  |
| Protein (g)             | 16–144      | 51 (20)       | 48 (49–54)          | 53 (M); 41 (W)   | 109.5 (48.0)                                   |
| Fat (g)                 | 10–115      | 41 (18)       | 38 (39–43)          |                  |  |
| Vitamin A ( $\mu$ g RE) | 52.4–3660.3 | 490.4 (360.0) | 394.0 (451.9–530.0) | 750              | 65.4 (48.1)                                    |
| Thiamine (mg)           | 0.1–1.4     | 0.4 (0.2)     | 0.4 (0.4–0.5)       | 0.8              | 54.9 (25.2)                                    |
| Riboflavin (mg)         | 0.2–3.2     | 0.7 (0.4)     | 0.6 (0.7–0.7)       | 1.2              | 57.8(31.1)                                     |
| Niacin (mg)             | 0.7–24.6    | 9.0 (3.8)     | 8.4 (8.6–9.4)       | 13               | 68.9 (29.3)                                    |
| Vitamin C (mg)          | 0.0–232.8   | 44.4 (36.7)   | 34.2 (40.5–48.4)    | 30               | 148.1(122.2)                                   |
| Iron (mg)               | 2.7–26.5    | 8.4 (4.4)     | 7.2 (7.9–8.9)       | 9                | 93.2 (48.5)                                    |
| Calcium (mg)            | 11.3–1927.9 | 325.8 (219.9) | 270.2 (302.2–349.4) | 450              | 72.4 (48.9)                                    |

M, men; W, women; <sup>a</sup>Malaysian Recommended Dietary Allowances (Tee *et al.* 1988); <sup>b</sup>calculated for each individual as (intake  $\div$  RDA)  $\times$  100, presented as mean (SD) of the sample; RE, retinol equivalent.

and nutrient database. The composition of simple sugar is not included in the Malaysian Food Composition Tables.<sup>15</sup> The percentage of contribution of fat to energy is 25% (Fig. 1) and was below the UK DRV<sup>19</sup> and the WHO<sup>16</sup> maximum recommended levels of 35 and 30%, respectively. Interestingly, the contribution of fat energy to the diet was significantly higher among women (27%) than among men (25%) (*P* < 0.05). Thus, significantly more men (32.3%) than women (21.4%) had estimated intakes of less than 10% of energy from fat (*P* < 0.05), which is the minimum level recommended in the UK diet to fulfil the requirement for fat-soluble vitamins and the essential fatty acids that have to be supplied by the diet.<sup>19</sup> The higher intake of fat among women may contribute to the greater risk of obesity among women (16.3%) than among men (8.1%).<sup>6</sup>

#### Micronutrients intakes

The intakes of thiamine, riboflavin, niacin, vitamin A and calcium of the subjects achieved only 55, 57.8, 68.9, 69 and 72.4% of the Malaysian RDA, respectively. In terms of the energy corrected values,<sup>19</sup> 52.2 and 86.6% of the subjects had intakes below the Estimated Average Requirement (0.3 mg/4200 kJ) and the Recommended Nutrient Intakes (0.4 mg/4200 kJ), respectively.

#### Food habits

Almost all of the subjects reported that they had breakfast (99.3%), lunch (97.9%) and dinner (90.4%) daily or almost

daily (5–6 times/week). Approximately 46 and 72% of the subjects, respectively, had taken morning tea and afternoon tea every day or almost every day (5–6 times/week). It was found that 89% of the subjects had three main meals (that is, breakfast, lunch and dinner), and 30.3% had consumed all five meals (that is, breakfast, morning tea, lunch, afternoon tea and dinner) daily or almost daily. Most of the subjects usually ate their meals at home, particularly dinner, with 99.3% always having dinner in their own home. A total of 20 subjects (13.2%), particularly men, regularly had morning tea at a restaurant or cafe. Having morning tea with friends at a restaurant or cafe, which is commonly referred to as *kedai kopi*, is a typical phenomenon among men in rural areas at retirement age.

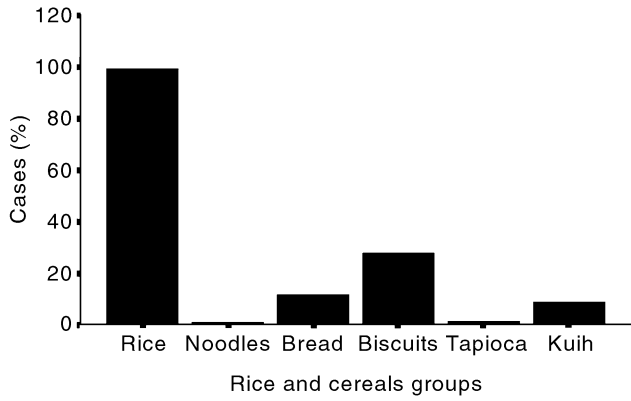
Figures 2–5 present the results of the qualitative food frequency questionnaire to examine the regular consumption of food (daily or at least once a week). Most of the subjects had eaten rice every day (99.2%). Approximately 27 and 11% of the subjects reported that they regularly consumed biscuits and traditional cakes (or *kuih*), respectively. These are usually consumed in between main meals as snacks. Among the animal protein choices provided, fresh fish (87.4%) was most likely to be consumed regularly, followed by seafood and its products such as dried salted fish, dried anchovies and fish chips. With respect to the dairy product options, only 10.3% and 3.8% of the subjects regularly had full cream milk or low fat milk powder, respectively. In contrast, nearly 38% of the subjects consumed condensed milk every day. Approxi-

mately 21–40% of the subjects had tofu, tempeh, nuts and beans regularly, with tofu being the most commonly consumed. Fruits were consumed on a daily basis by only 18% of the subjects. Figures 6 and 7 present the preferences in cooking main dishes. In cooking fish and poultry, most of the subjects preferred deep-frying (70%), followed by boiled (for example, soup; 18%), baked or grilled (16%), braised in

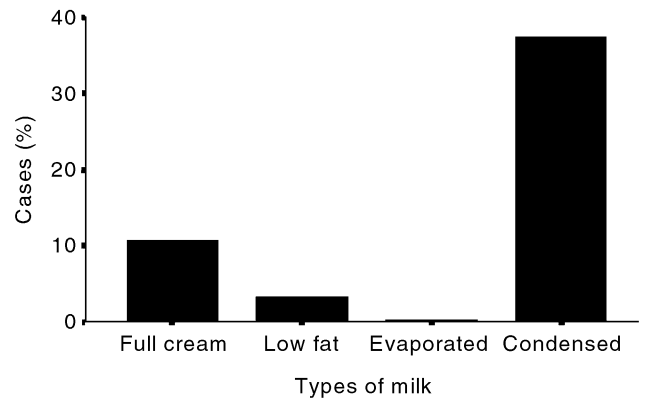
*santan* or coconut milk (4%), and steamed (2%). With respect to the cooking of the vegetables, most of the subjects preferred to stir-fry (35%) or to stir-fry with the addition of a small amount of water or *tumis air* (34%). Approximately 10% of the subjects preferred to eat the vegetables raw or *celur* (boiled and drained).

**Food beliefs**

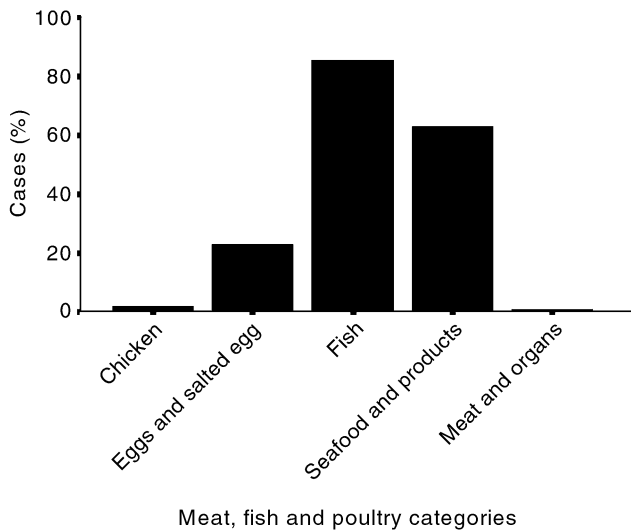
Nearly half of the subjects (49%) reported that they had particular health beliefs about specific foods, believing that they



**Figure 2.** Reported regular consumption of rice, cereals and its products (expressed as percentages).



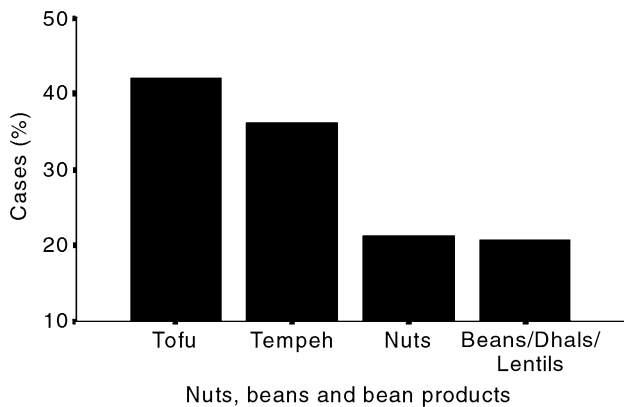
**Figure 5.** Reported regular consumption of milk in 337 subjects (expressed as percentages).



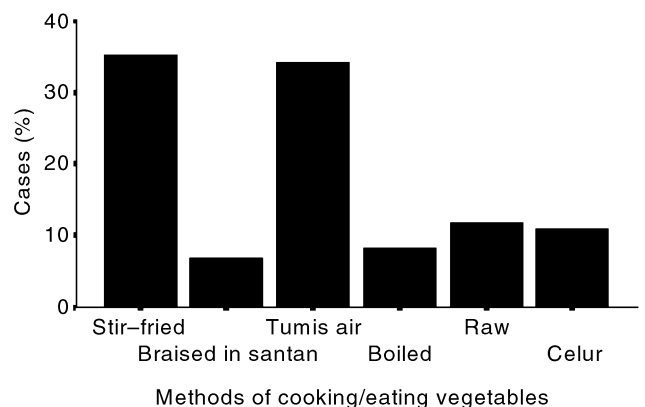
**Figure 3.** Reported regular consumption of meat, fish and poultry (expressed as percentages).



**Figure 6.** Preferred methods for cooking meat, fish and poultry in 337 subjects (expressed as percentages).



**Figure 4.** Reported regular consumption of nuts, beans and its products (expressed as percentages).



**Figure 7.** Preferred methods for cooking or eating vegetables in 337 subjects (expressed as percentages).

were either good or bad for the health of elderly people. Significantly, more women (55%) than men (42%) were practising such beliefs at the time of the survey ( $P < 0.05$ ). Table 3 shows the variety of foods believed to have particular effects on the health of elderly people. The foods have been categorized as 'cooling', 'windy', 'hot', 'sharp', 'poison' or 'itchy' according to the classification used in a study of food prohibitions among Malays during confinement, lactation, pregnancy and at preschool age.<sup>22</sup> Two food groups, not previously used, have been added in this study: are 'beverages' and 'fatty foods'. A variety of foods, particularly fruits and vegetables, were commonly avoided because they were regarded as being 'cool' ( $n = 83$ ), 'windy' ( $n = 29$ ), 'hot' ( $n = 31$ ) or 'sharp' ( $n = 24$ ). These foods were claimed to cause adverse effects on health such as joint numbness and pain, aching knees, poor blood circulation, gastrointestinal discomfort, heartburn, asthma and coughing. A total of 21 subjects also believed that beverages such as tea, coffee and instant coffee, and cocoa drinks may cause constipation, headache and stomach-ache. Fifteen subjects believed that certain types of foods such as red meat, ghee rice and coconut rice (rice cooked with ghee or coconut, respectively) are fatty and can cause nausea and high blood pressure.

### Discussion

The energy intakes of individuals in the present study were positively correlated with the BMI ( $r = 0.1024$ ,  $P < 0.05$ ), suggesting that intakes were not seriously over- or under-reported. The estimated energy intake was found to be below the Malaysian RDA by 21%. Comparison of energy intakes with a value such as the Malaysian standard may not provide a satisfactory indication of the adequacy of energy intakes because energy requirements differ greatly among individuals due to variations in basal metabolism and physical activities. Nevertheless, the requirements used were adjusted for sex, age and, to a limited extent, physical activity. Using the WHO recommendation adjusted for body size of 126 kJ/kg/bodyweight/day,<sup>17</sup> over 60% of the subjects had reported low intakes. Low energy intakes among elderly people have also been reported in other studies in developing countries.<sup>7-10</sup> In Malaysia, protein energy malnutrition (PEM) has long been recognised as a nutritional problem among children in rural areas.<sup>5</sup> Apparently, elderly people are also at a similar risk. In this study, over a third of the subjects, particularly women, had an intake of below 5040 kJ/day, a level which is associated with an increased risk of deficiencies in micronutrients.<sup>20</sup> There was also a decline in energy intake with advancing age, which is in agreement with results from longitudinal studies<sup>23,24</sup> and cross-sectional studies.<sup>25,26</sup> However, elderly women who maintained their health status had similar dietary intakes approximately 7 years after the original study.<sup>27</sup> Therefore, the observed decline in energy intake may be due to an increase in immobilising diseases and disabilities and a reduction in physical activity during old age.<sup>28</sup>

Rice is the staple food and the major source of dietary energy of this population. Household food consumption surveys in rural areas carried out in the mid 1980s indicated that the main sources of energy were rice (51%), sugar (14%), fats and oils (11%), wheat and its products (10%), fish (4%), poultry, eggs, milk and meat (4%), roots and tubers (2%),

fruits and vegetables (2%), and nuts and pulses (2%).<sup>20,27</sup> Data from the Malaysian food balance sheets between 1964 and 1966 and from 1986 to 1988 indicated an overall trend of a decrease in the proportion of energy from carbohydrates, a rise in the percentage of energy from fat and a small increase in the proportion of energy from protein.<sup>29</sup> However, the dietary pattern of the elderly subjects aged 60 years and above remained traditional, with a high percentage of food energy derived from carbohydrates (61%) and less from protein (14%) and fat (25%). Also, the changes shown in the food balance sheets include urban areas, where the largest increases in fat consumption would be expected to occur.

In general, this traditional diet meets the WHO guidelines in preventing chronic diseases.<sup>16</sup> The prevalence of chronic diseases such as heart disease (5.2% in men and 7.3% in women) and hypertension (21.5% in men, 24.2% in women) among rural elderly Malays<sup>30</sup> is rather low when compared with, for example, their peers in Canada, where the prevalence of heart disease is 27% in men and 30% in women, and hypertension is 32% in men and 50% in women.<sup>31</sup> It should be borne in mind that other factors such as life expectancy, physical activity and socioeconomic status may contribute to the differences in disease prevalence between populations. However, data from the early food consumption studies<sup>29</sup> suggest that the intake of simple sugars may be above the WHO recommendation of 10–11%.<sup>16</sup> The risk of a high consumption of simple sugar and a possible concomitant reduction in complex carbohydrates needs to be investigated further.

In developing countries, diets that are low in total fat tend to be high in 'bulky' foods, with a high fibre and water content.<sup>18</sup> The main concern is that the total volume of food may restrict energy intakes in young children and elderly people. The WHO recommends that fat intakes for infants and very young children should be increased to allow catch-up growth of children with various degrees of malnutrition in developing countries.<sup>18</sup> However, it is not clear whether the recommendations for the percentages of energy from each of the macronutrients should be different for elderly people as opposed to younger adults.

Despite the low energy intakes, absolute protein intakes appeared to be adequate among the subjects. This finding is consistent with those reported among younger adults and children in Malaysia.<sup>5,32</sup> It appeared that the sources of dietary protein of the subjects were plants, particularly rice, and animals and animal products, such as fish, fish chips, eggs and poultry. Since fishing is the main occupational activity of the population, it is not surprising that fish is the main animal protein source, with 87% of the subjects consuming fish daily. In an earlier survey among 110 households in rural areas of Mersing, 35 and 34% of dietary protein were supplied from rice and fish, respectively.<sup>22</sup> Although the protein intakes appeared to be adequate, approximately one-third of the subjects had an intake below the WHO recommendation of 0.8 g/kg BW.<sup>17</sup> It is important to note that if energy intakes are low, protein may be metabolised to provide energy, leading to PEM. Hypoalbuminaemia, which may indicate PEM,<sup>33</sup> was evident in at least a third of the subjects.<sup>12</sup>

Although the mean intakes of some nutrients such as thiamine, niacin and iron were significantly higher in men than

**Table 3.** Food beliefs among elderly Malays (multiple answer response<sup>a</sup>)

| Classification | Food items  | Reasons for avoidance <sup>b</sup>   | Frequency |
|----------------|---|--|-----------|
| Cooling foods  | Vegetables (e.g. pumpkin, cucumber, mushrooms, long beans, aubergine, mustard leaf, swamp cabbage, coconut shoot, okra)<br>Fruits (e.g. jackfruit, papaya, rambutan, banana, <i>cempedak</i> , watermelon, <i>kundur</i> , sugar cane juice)<br>Glutinous rice<br>Iced drink<br>Overnight leftover rice | Joint numbness/pain, poor blood circulation, stomach-ache, knee-ache, asthma, cough. | 83        |
| Windy foods    | Vegetables (e.g. pumpkins, starfruit, sweet potatoes, cassava leaves, water cress, aubergine)<br>Milk<br>Fruits (e.g. jackfruit)  | Windy stomach, nausea  | 29        |
| Hot foods      | Beef bone, red meat<br>fruits (e.g. durian)   |  | 31        |
| Sharp foods    | Vinegar, chicken's liver<br>Vegetables (e.g. bamboo shoot, chillies, lemon grass)<br>Fruits (e.g. mangosteen, sugarcane, pineapple, mango, lime, coconut juice, starfruit, sugar cane juice)  | Heartburn, stomach-ache  | 24        |
| Poison foods   | Fish and seafood (e.g. <i>sembilang</i> , <i>duri</i> , stringray, mussels)<br>Vegetables (e.g. <i>pucuk manis</i> )  | Dizziness, headache, high blood pressure, body numbness                              | 12        |
| Itchy foods    | Chicken, red meat, seafood (e.g. prawns, prawns paste, mussels)   | Skin problems (eczema)   | 12        |
| Beverages      | Tea, coffee, instant coffee, cocoa drinks   | Constipation, headache, stomach-ache   | 21        |
| Fatty foods    | Red meat, chicken<br>Coconut rice, ghee rice  | Nausea, high blood pressure  | 15        |

<sup>a</sup> A subject may provide more than one answer, <sup>b</sup> Reasons apply for most or all of the foods in the particular food classification.

in women, the differences were not found when expressing the data in relation to energy intake. Similar trends were observed for the differences between age groups within a specific sex for thiamine, niacin and calcium. These findings suggested that the micronutrient intakes were related to the wide variation of energy intakes between individuals of different sex, or age groups within each sex.<sup>16</sup> Despite differences in the dietary methodologies, those nutrients identified as being below recommended levels (that is, vitamin A, thiamine, riboflavin, niacin and calcium) were similar to those reported by other investigators in developing countries.<sup>7-10</sup> However, the blood levels of plasma retinol were within the normal range,<sup>12</sup> suggesting adequate liver stores and reduced renal clearance of retinyl esters.<sup>34</sup> It appeared that the elderly subjects studied had built up their hepatic stores of vitamin A from a wide range of intakes consumed over a long period. However, the vitamin A requirement set for elderly people is probably higher than the actual need. The main sources of vitamin A of the study population are plants, including vegetables (for example, sweet potatoes, dark green leafy vegetables and pumpkin); yellow fruits (for example, papaya

and mango); and palm oils and animal sources (for example, egg yolk and fatty fish). An early study in rural areas in Peninsular Malaysia indicated that more than 80% of the vitamin A in traditional diets was derived from plant sources or  $\beta$ -carotene.<sup>35</sup> An average of one-sixth of the  $\beta$ -carotene is converted to vitamin A in the intestinal mucosa.<sup>36</sup>  $\beta$ -carotene in oily solutions such as palm oil or in fruit juices such as mango, commonly consumed among the study population, is more efficiently utilised than is carotene in carrots, the typical carotenoid sources in Western diets.<sup>36</sup> It is prudent for elderly people to have an adequate intake of  $\beta$ -carotene for its likely protective effect against cancer.<sup>14</sup>

The thiamine intake was also low, with the estimated mean intake just meeting the recommended requirement for achieving both clinical and biochemical normality (0.3 mg/4200 kJ/day).<sup>19</sup> The low thiamine intake is not unexpected since the staple diet of the population is polished rice which is low in thiamine, and foods are not commonly fortified. An inadequate dietary thiamine intake is more likely to result in poor thiamine status in elderly people than in other age groups, partly because it is less well absorbed



with advancing age.<sup>20</sup> Elderly Malays are also known to regularly consume coffee, which reduces the absorption of thiamine at any age.<sup>37</sup> Poor thiamine status is associated with anorexia, weight loss, fatigue, sleep disorders, and depression, which are associated with malnutrition.<sup>27</sup>

Riboflavin intakes were also extremely inadequate, with the women and the older men at a greater risk of having inadequate riboflavin intakes. The inadequate riboflavin intakes were manifested by the poor biochemical riboflavin status as assessed through erythrocyte glutathione reductase activation coefficient.<sup>12</sup> Inadequate riboflavin intake and status is a serious problem in elderly people since it may result in clinical signs of deficiency. These are mainly lesions of the mucocutaneous surfaces of the mouth (angular stomatitis, cheilosis, atrophic lingual papillae, glossitis and magenta tongue) that could affect the ability to eat.<sup>38</sup> Chronic riboflavin deficiency has been associated with the formation of senile cataracts and iron deficiency anaemia.<sup>39</sup> In this study, subjects were not examined for specific clinical signs of nutrient deficiencies.

Poor riboflavin intake and status among the subjects were not unexpected as the richest sources of riboflavin (for example, meat and dairy products) are rarely consumed in this study population. Meat is regarded as an expensive food that is occasionally consumed during religious or cultural ceremonies, while dairy products are not traditionally taken as part of the diet. Only 13.8% of the sample regularly consumed full-cream or low-fat milks, with a higher proportion of subjects (36.8%) taking condensed milk (made as a by-product of palm oil), which is much cheaper than the dairy products but is not a good source of riboflavin. Thus, an inadequate intake of riboflavin in the subjects was probably due to their inability to purchase foods that are good sources of riboflavin. It should also be pointed out that the elderly subjects may also have refused to consume dairy products due to perceived lactose intolerance.<sup>40</sup>

As for riboflavin, women were at a greater risk of consuming diets inadequate in niacin, being approximately twice as likely as men to be consuming diets with niacin intakes below the recommendation. The vitamin C intakes appeared to be adequate, probably due to the survey taking place during the fruit season. Other studies investigating the diets of elderly people in developing countries,<sup>7-9</sup> have reported inadequate vitamin C intakes. However, it is not clear whether or not those studies were carried out during fruit seasons.

The mean calcium intake of the subjects was well below the estimated 1500 mg of calcium that may be needed to maintain calcium balance in postmenopausal women for the prevention of osteoporosis.<sup>41</sup> The older subjects, both men and women, were at a greater risk of consuming inadequate calcium. It appears that the iron intakes of the subjects were not as low or unsatisfactory as other micronutrients such as vitamin A, thiamine, riboflavin, niacin and calcium, probably due to the relatively adequate protein intake, as protein foods are usually good sources of iron. It should be noted that the iron intake was positively correlated with the haemoglobin concentration.<sup>12</sup> This finding suggests the importance of the total dietary iron intake in improving haematological indices such as haemoglobin in this population, although other factors influence the bioavailability of iron.

Almost all of the subjects reported that they had regular breakfast, lunch and dinner, indicating good dietary habits. However, approximately half of the subjects, especially women, had particular beliefs and prohibitions about specific foods which they regarded as bad for the health of elderly people. Vegetables and fruits were most commonly avoided, because they were regarded as cool, hot, windy or sharp foods, which could cause joint numbness and pain, aching knees, poor blood circulation, gastrointestinal discomfort, heart burn, asthma and coughing. Food beliefs and prohibitions known to strongly influence the dietary pattern of rural Malays have been reported previously among pregnant and lactating mothers and children.<sup>22</sup> The findings that these beliefs also exist among elderly people needs to be appropriately addressed. The avoidance of certain foods would further restrict the variety of foods consumed in an already monotonous rural diet. Vegetables and fruits are the main sources of nutrients such as fibre, ascorbic acid and  $\beta$ -carotene in the Malaysian diet.

In conclusion, the rural elderly Malays investigated in this study were at a similar risk of low energy intakes leading to PEM as has been reported among other vulnerable groups such as preschool children and pregnant women. In addition to the low energy intakes, the mean intakes of all of the nutrients investigated were below the RDA, with the exceptions of protein and vitamin C. Appropriate interventions such as the promotion of foods with a high ratio of nutrients to energy as well as emphasis on regular consumption of in-between meals (snacks) are desirable for improving the quantity and quality of the diet of the elderly population.

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