Original Article

A multidimensional assessment of nutritional and health status of rural elderly Malays

Suzana Shahar PhD[1], Zuriati Ibrahim MSc[1], Afaf Ruhi Abdul Fatah MSc[2], Suriah Abdul Rahman PhD[2], Noor Aini Mohd Yusoff PhD[1], Fatimah Arshad PhD[1], Zaitun Yassin PhD[3] and Siti Nur 'Asyura Adznam BSc[1]

[1]*Department of Nutrition and Dietetics, Faculty of Allied Health Sciences, Universiti Kebangsaan Malaysia, Jalan Raja Muda Abdul Aziz, 50300 Kuala Lumpur*
[2]*Food Science Programme, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor*
[3]*Department of Nutrition and Dietetics, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Serdang, Selangor*

A multidimensional assessment of nutritional and health status comprised of subjective global assessment (SGA), anthropometry function, biochemistry, dietary intake, social and health aspects was carried out on 820 older people (52.8% men and 47.2% women) from four rural areas of Peninsular Malaysia. A proportion of the subjects had been classified as either overweight (25.7%) or chronic energy deficient (20.3%). Although 49% of subjects had normal body weight, 68.4% have been classified as having mild to moderate malnutrition according to the SGA. Only 1.1% and 2.3% had low serum albumin and ferritin, respectively. Almost 80% of subjects, especially men, were at high risk of cardiovascular diseases on the basis of the assessment of total cholesterol and LDL-cholesterol. The majority of the subjects (87.2%) were fully independent in performing daily tasks, with men having a significantly higher score compared to women ($p<0.001$). However, men were less likely to be able to perform a flexibility test (50.7%) than were women (27.0%) ($p<0.05$). The mean energy intake for men (1412 ± 461 kcal/d) and women (1201 ± 392 kcal/d) were below the Recommended Nutrient Intake (RNI) for Malaysia, although this is a difficult assertion to make in an age-group which generally experiences declining energy expenditure. Moreover, 52.5% of men and 47.5% of women might have underreported their food intake. Dietary micronutrients most likely to be deficient were thiamin, riboflavin and calcium. It is concluded that a substantial proportion of rural elderly Malays had problems related to both undernutrition and overnutrition. An appropriate nutrition intervention program is needed to improve the nutritional status of rural elderly Malays.

Key Words: nutritional status, functional status, food intake, older people, anthropometry

Introduction

In Malaysia, the ageing population is growing steadily as a result of the decline in birth rate and mortality rate and also due to the reduction in infectious diseases and improvemenst in the health care system.[1] The elderly population has increased two-fold in 20 years, from 685,000 in the year 1975 to 1,463,400 in the year 2000.[2] With the continuing growth of this population in Malaysia, there is a need to document their nutritional and health status in order to formulate strategies to promote health and prevent nutritional problems that can lead to increase risk of morbidity and illness. Older people are at a higher risk of malnutrition, not only because of food insecurity, but also due to various social, physiological ad health changes with ageing.[3]

Several studies have evaluated the nutritional and health status of Malaysian elderly.[4-7] However, the studies were generally conducted on small samples and have used limited dimensions of nutritional and health status, such as anthropometry and dietary intake. The assessment of nutritional status requires the integration and interpretation of at least anthropometry, biochemical and dietary intake.[8] Rural elderly Malays have been reported to be at greater risk of malnutrition[4] and expressed more need of health services than their urban counterparts.[9] Rural elderly populations have prevalences of chronic energy deficiency (BMI < 18.5 kg/m^2) which range from 17.7% to 37.7% as compared to 2.0 to 3.0 for their urban counterparts.[10] In view of the presumed nutritional vulnerability of this aged population, a cross sectional study was carried out on a large sample of elderly Malays from four rural areas of Malaysia to assess the current nutritional and health status through a multi-dimensional indicator.

Corresponding Author: Dr. Suzana Shahar, Department of Nutrition & Dietetics, Faculty of Allied Health Sciences, Universiti Kebangsaan Malaysia, Jalan Raja Muda Abdul Aziz, 50300 Kuala Lumpur, Malaysia.
Tel: 603-40405335; Fax: 0326947621
Email: suzanas@medic.ukm.my
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Table 1. Dimensions, indicators and methods of nutritional and health assessment

Dimension	Indicators	Methods
Social and health	Social and health data	Interview-based questionnaire
Anthropometry: Body size & composition	Weight, height, armspan, waist-hip ratio, midupper arm circumference, skinfold thickness.	Standard anthropometric Measurements [33]
Physical health examination	Subjective Global Assesment (SGA)	Standard measurement [12]
Functional status	Mobility, physical capacity, hand grip strength, cognitive.	Elderly Mobility Scale (EMS), [14] Instrumental Activities of Daily Living (IADL), [15] Handgrip Dynamometer and Hodkinson Abbreviated Mental Test. [16]
Biochemical nutritional status	Serum albumin, fasting serum lipid (FSL), serum ferritin and fasting blood sugar (FBS).	Automated Analyser (Cobas Integra BioAutoanalyser version 2.2); AxSym machine[34]; Glucometer (Roche Diagnostic)
Dietary intake	Nutrient intake, dietary habit and behaviour.	Validated dietary history questionnaire[35]

Methods

A multi-stage random sampling according to 'mukim' or province, followed by village ,was carried out to select eligible elderly Malays residing in rural areas of Kuala Pilah, Negeri Sembilan; Sabak Bernam, Selangor; Kodiang, Kedah and Pasir Mas, Kelantan.. The subjects were selected based on geographical coverage of the North, South, East and West. In Sabak Bernam, all six 'mukim' were studied with a total of two to four villages from each 'mukim' as the sampling frame. In Kuala Pilah, four 'mukim' from a total of eleven 'mukim' were selected. All eligible elderly persons who were Malays, aged 60 and above, and residents of the selected rural areas for at least 12 months prior to the study period, ambulatory, with no mental or critical illness from the selected villages were invited to participate in the screening process at respective health centres. The multidimensional aspects of the nutritional and health assessment are summarized in Table 1. The data were collected by dietitians, nutritionists, trained nurses and interviewers. Prior to the study, the questionnaire was pre-tested and the interviewers were trained using a standard protocol.

Body Mass Index (BMI) was calculated using weight and height, the latter derived from an equation for its prediction from arm-span, which has been developed and validated among Malaysian adults and elderly people. [11] Instead of standing height, armspan was used because height measurement in the elderly may impose some difficulties and the reliability is doubtful. Specifically, the clinical status of the subjects was determined using SGA (Subjective Global Assessment) that includes a subjective assessment of past medical history (i.e. weight changes, diet modification and appetite, gastrointestinal symptom, functional ability and the presence of metabolic stress or illness) and physical examination for subcutaneous fat loss, bilateral muscle loss, ascites, ankle and sacral edema.[12,13] Based on these assessments, subjects were classified into normal (A), mild to moderate malnutrition (B) and severe malnutrition (C). As shown in Table 1, functional status was assessed using objective measurements which included a mobility test [Elderly Mobility Scale (EMS)] [14] and hand grip strength. The subjects were also interviewed to obtain information about their ability to perform daily activities [Instrumental Activities of Daily Living (IADL)][15] and cognitive performance [Hodkinson Abbreviated Mental Test].[16] In particular, the IADL questionnaire[15] was used to assess the subjects ability to perform seven daily activities (i.e. ability to use telephone, public transport, to do housework, manage money, walk for 100 m, prepare own food and take medications). The subjects' ability was assessed using three scales (i.e. score 0: not able or dependant, score 1: able to perform task with help, score 3: able to perform task without assistance of special aids or other people). The maximum score was 14.

A total of 5 ml fasting venous blood was taken and centrifuged at 3000 rpm, 25^0C for 10 minutes using a portable microcentrifuge. The serum was pipetted into two 3 ml appendauf tubes and stored at a freezer -8^0C before being transported within one week to the Chemical Pathology Laboratory at Hospital Universiti Kebangsaan Malaysia. At the laboratory, the samples were stored at -80^0C for 3 months before being analysed for Fasting Serum Lipid (FSL), serum ferritin and serum albumin. Body Mass Index (BMI) was calculated using weight and height. The height was derived from the arm-span measurement. [11] Nutrient intake was determined from the food intake data using Nutrical Software. The Statistical Package for Social Sciences (SPSS) was used to analyse the data.

Results and discussion

A total of 820 elderly Malays (52.8% men and 47.2% women), aged 60 - 97 years, mean (SD) 69.0 ± 6.75 years, participated in the study. The majority of subjects were still married (68.4%), stayed together with spouse (31.9%) or spouse and children (36.7%) (Table 2). Almost half of the subjects depended on others for economic resources. However, only 6% reported that they did not have enough money to buy food. Women were more likely to be living alone (p<0.05) and be unemployed with no pension (p<0.05). Approximately 90% of men were still married.

Table 2. Demographic and socioeconomic characteristics according to sex and age group [presented as number (%)]

Characteristics	Men			Women			Total (n=820)
	60-74 y (n=336)	≥75 y (n=97)	Total (n=433)	60-74y (n=313)	≥75 y (n=74)	Total (n=387)	
Maritial status:							
Single	1 (0.3)	0 (0.0)	1 (0.2)	1 (0.3)	2 (2.7)	3 (0.8)	4 (0.5)
Married	313 (93.2)	79 (81.4)	392 (90.5)*	156 (49.8)	13 (17.6)	169 (43.7)	561 (68.4)
Widowed/divorced	22 (6.6)	18 (18.5)	40 (9.3)	156 (49.8)	59 (79.7)	215 (55.6)	255 (31.1)
Living arrangement:							
Alone	10 (3.0)	6 (6.3)	16 (3.7)	51 (16.3)	23 (31.9)	74 (19.3)	90 (11.1)
Spouse	126 (37.8)	50 (52.6)	176 (41.1)**	74 (23.7)	9 (12.5)	83 (21.6)	259 (31.9)
Spouse and children	183 (55.0)	28 (29.5)	211 (49.3)***	84 (26.9)	3 (4.2)	87 (22.7)	298 (36.7)
Children/relatives	14 (4.2)	11 (11.6)	25 (5.8)	103 (33.0)	37 (51.4)	140 (36.5)***	165 (20.3)
Employment:							
Unemployed	59 (19.0)	42 (48.3)	101 (25.4)	248 (82.9)	65 (92.9)	313 (84.8)	414 (54.0)
Retired	55 (17.7)	8 (9.2)	63 (15.8)	5 (1.7)	0 (0.0)	5 (1.4)	68 (8.9)
Employed	197 (63.3)	37 (42.5)	234 (58.8)	46 (15.4)	5 (7.1)	51 (13.8)	285 (37.1)
Depended on others for economics sources	90 (28.3)	47 (52.8)	137 (33.7)	185 (63.1)	58 (86.6)	243 (67.5)***	380 (49.5)
Did not have enough money to buy food	13 (4.1)	7 (7.9)	20 (4.9)	16 (5.5)	10 (14.9)	26 (7.2)	46 (6.0)

*p<0.001, **p<0.01, ***p<0.05, chisquared test

Table 3. Median score of IADL, mobility, cognitive test (median ± range between quintile) and handgrip strength (mean ± SD) according to sex and age group

Parameters	Men			Women			Total (n=631)
	60-74 y (n=278)	≥ 75 y (n=78)	Total (n=356)	60-74 y (n=225)	≥ 75 y (n=50)	Total (n=275)	
IADL score	14 ± 1	13.5 ± 2.25***	14 ± 1	13 ± 3	10.5 ±7.25****	12 ± 4‡	14 ± 2
Mobility score	19 ± 2	18 ± 1*	19 ± 1	19 ± 2	18 ± 2.5**	18 ± 2†	19 ± 1
Cognitive score	9 ± 2	8 ± 3.25***	9 ± 2	7 ± 4	4 ± 2***	6 ± 4‡	8 ± 4
Handgrip strength (kg)	19.6 ± 5.27	16.4 ± 4.48§	18.8 ± 5.27	13.7 ± 4.37	11.4 ± 3.49§	13.3 ± 4.31¶	16.4± 5.59

*p<0.05, **p<0.01, ***p<0.001, differences between age group within the same sex, Mann-Whitney test. †p<0.05, ‡p<0.001, differences between sex, Mann-Whitney test. §p<0.001, differences between age group within the same sex, independent t test at 2 tail. ¶p<0.001, differences between sex, independent t test at 2 tail.

The socio-demographic phenomena were not different to other studies among various ageing populations worldwide which indicate that around 60 to 90% elderly men are married and taken care of by their spouse.[17-19]

A total of 19.3% of women were living alone and possibly at risk of various nutritional and health problems including malnutrition.[20] As reported previously,[21] hypertension is the most commonly reported chronic disease among such subjects (32.7%). This is followed by gout or arthritis (29.6%), diabetes mellitus (11.7%), cardiovascular diseases (8.4%) and gastrointestinal disorders (8.7%). Almost one third of the subjects perceived their health to be satisfactory to good, especially among men and the younger elderly. Only 13.8% reported their health as poor.

Functional status, as assessed using IADL, revealed that the majority of subjects (87.2%) were fully independent in performing daily tasks such as housekeeping, shopping, handling money, using public transport, ability to walk and manage money, with men having a significantly higher score compared to women (p<0.05). Similar trends were also noted for the functional score of EMS, hand grip strength and cognition (Table 3). Functional status as assessed by handgrip strength was positively correlated with nutritional status as measured using BMI. However, it should be noted that the Pearson correlation coefficients were low in each situation (Table 4). There was a trend for functional status, as measured using IADL, mobility, cognitive function and handgrip strength, to deteriorate with advancing age, for both genders changes were most evident for IADL and cognitive function (Table 3).

Out of 413 subjects who completed screening for BMI, SGA, serum albumin and serum ferritin, only 21.8% were regarded as 'healthy', with no signs of under- or over-nutrition as defined here. Rural elderly Malays face both the problems of under and over nutrition, with 20.3% and 25.7% categorized as chronic energy deficient (CED) and

Table 4. The relationship between handgrip strength and nutritional status

Functional status	BMI	MUAC	Serum ferritin	Serum albumin
Hand grip strength	0.153*	0.174*	0.188*	0.181*

*p<0.01, Pearson correlation test at 2 tail

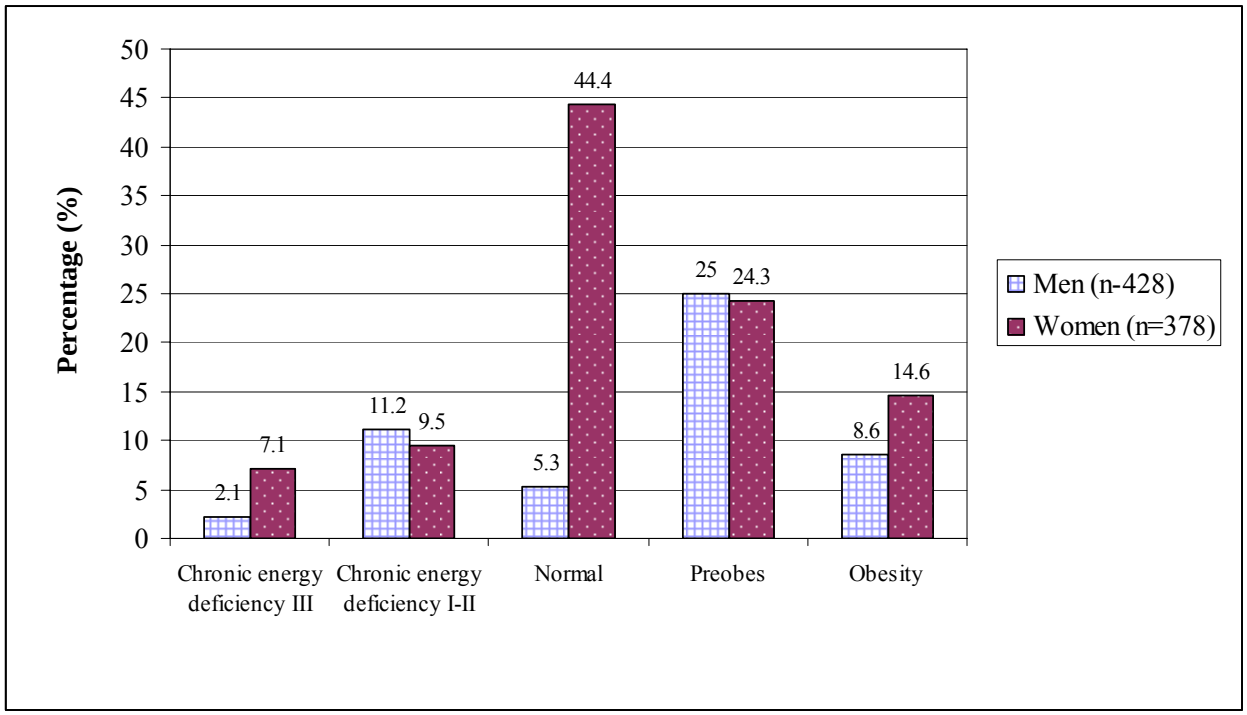

Figure 1. Prevalence of chronic energy deficiency and obesity as assessed using BMI derived from armspan (%)

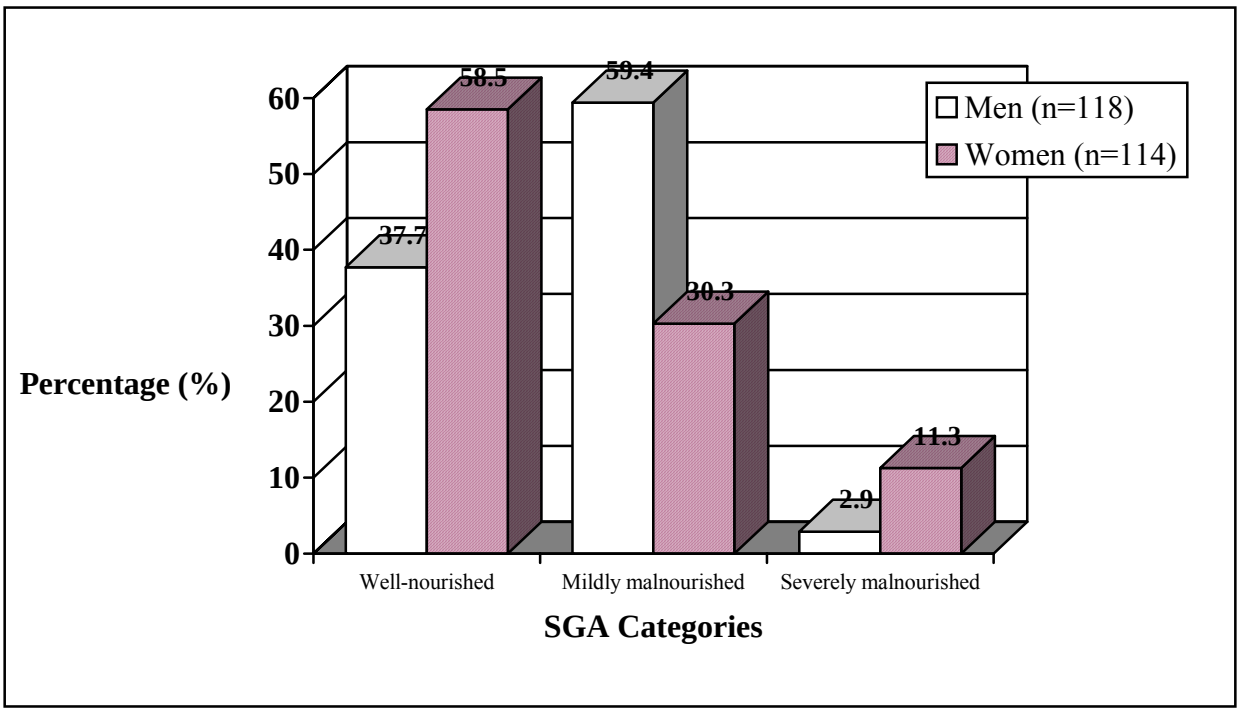

Figure 2. Prevalence of malnutrition as assessed by SGA (%)

overweight, respectively (Fig 1). A comprehensive physical assessment using SGA revealed that 48.5% and 6.1% of subjects could be classified as mildly and severely malnourished, respectively (Fig 2). Thus, a substantial proportion of elderly subjects had likely underlying nutritional contributors to their health problems. Table 5 indicates that all undernourished subjects (BMI < 18.5 kg/m^2) were also diagnosed as malnourished according to SGA. Although none of the obese subjects was diagnosed as severely malnourished according to SGA, 24.2% of the

Table 5. Prevalence of malnutrition according to SGA, BMI and MUAC (n=501) [expressed as number (%)]

SGA classification [12]	BMI		
	Chronic Energy Deficiency† (n=58)	Normal‡ (n=253)	Obese§ (n=190)
A-Normal	0	71 (28.1)	144 (75.8)
B-Mild to Moderate Malnutrition	25 (43.1)	173 (68.4)	46 (24.2)
C-Severe Malnutrition	33 (56.9)	9 (3.6)	0

†BMI: <18.5 kgm^{-2} ; ‡BMI: >18.5 - < 25 kgm^{-2}; §BMI: ≥ 25.0 kgm^{-2}

obese had mild to severe malnutrition according to SGA. Furthermore, 68.4% of subjects with normal BMI were also categorized into the mild to severe malnutrition. These subjects could have experienced of a weight loss more than 5% in the past month, loss of appetite or had gastrointestinal symptom recently. These findings indicated that the loss of subcutaneous fat or muscle as explained in the methods section can be detected sensitively by SGA, but not via BMI. It is known [22] that malnutrition evidenced by sarcopenia or low muscle mass can be present in elderly people with a normal BMI. The use of BMI alone is not sufficient to assess malnutrition in older people.

The prevalence of hypercholesterolemia (TC > 5.2 mmol/l), hypertriglyceridemia (TG > 1.4 mmol/l) and high LDL values (LDL > 3.8 mmol/l) according to the NCEP cut off points [23] were 67%, 45% and 72%, respectively, with women more likely to be hypercholesterolemic (p<0.05) but with less frequent low HDLs (p<0.05) (Fig 3). The ratio of TC/ HDL (5.23) and the ratio of LDL/HDL (3.59) were also above the recommended cut off points [24] of 4.5 and 3.0, respectively. However, only 8.4% of the subjects reported that they were diagnosed with cardiovascular diseases. The high prevalence of dyslipidaemia requires further evaluation as 27.6% of the causes of death are attributed to cardiovascular disease. Hyperglycaemia (FBS > 6.7 mmol/l, a cut –off considerably higher than most now recommend for Impaired Glucose Tolerance) occurred in 11.3% men and 13.8% women.

The prevalence of hypoalbuminaemia (serum albumin < 33 g/dL) [25] was very low (1.1%) compared to the reported value of 36% among rural elderly Malays in Mersing, Johor.[26] Iron deficiency as indicated by serum ferritin level (< 12 ng/ml) [27] was only detected in 1.4 % in men and 2.6 % in women. It appears that severe protein and iron deficiencies were absent from this population.

The mean intake of energy was 1412 ± 461 kcal/d in men and 1255 ± 403 kcal/d in women which achieved only 70.2% and 70.5% of the RNI (Recommended Nutrient Intake), respectively. Low energy intake near to the RMR (Resting Metabolic Rate) is often reported among older people.[4,6] Elderly people usually consume foods in small amounts and less frequently as compared to younger individuals. In part this compensates for lower levels of energy expenditure, but at the risk of compromised essential nutrient intakes unless nutrient density is exceptionally high in the foods eaten. But it also increases the risk of chronic energy deficiency (CED), especially during acute and chronic illness when the energy requirement is high.[28] Nevertheless the protein intake (57.0 ± 21.7 g/d in men and 53.7 ± 21.8 g/d in women) was apparently adequate, i.e achieving 96.6% of RNI in men and 105.2% in women. Low energy with adequate protein intakes will result in the protein being used as to a greater extent as an energy source, rather than for muscle building (which also requires strengthening exercise). This can, therefore, lead to protein energy malnutrition [29] and also to low bone density.[30]

Calcium, niacin, thiamin and vitamin A were the micro-nutrients most likely to be deficient in the diet of the elderly Malays, as more than half of them consumed less than 2/3 of the RNI (Fig 4). The findings are consistent with other studies among rural elderly Malays.[4,31]

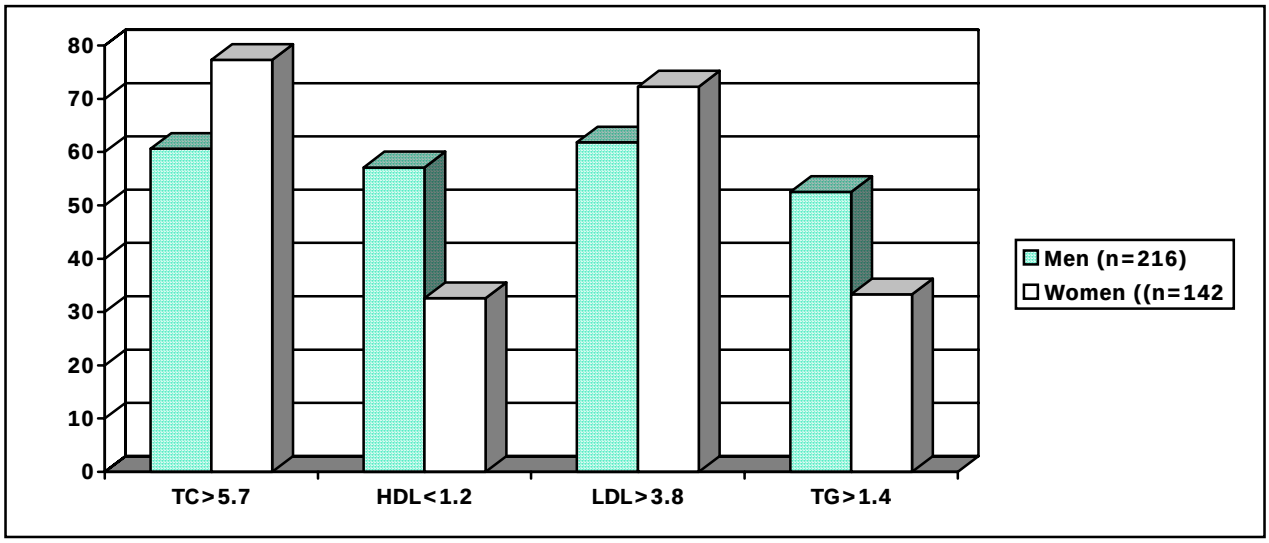

Figure 3. Percentage of subjects with abnormal lipid profile

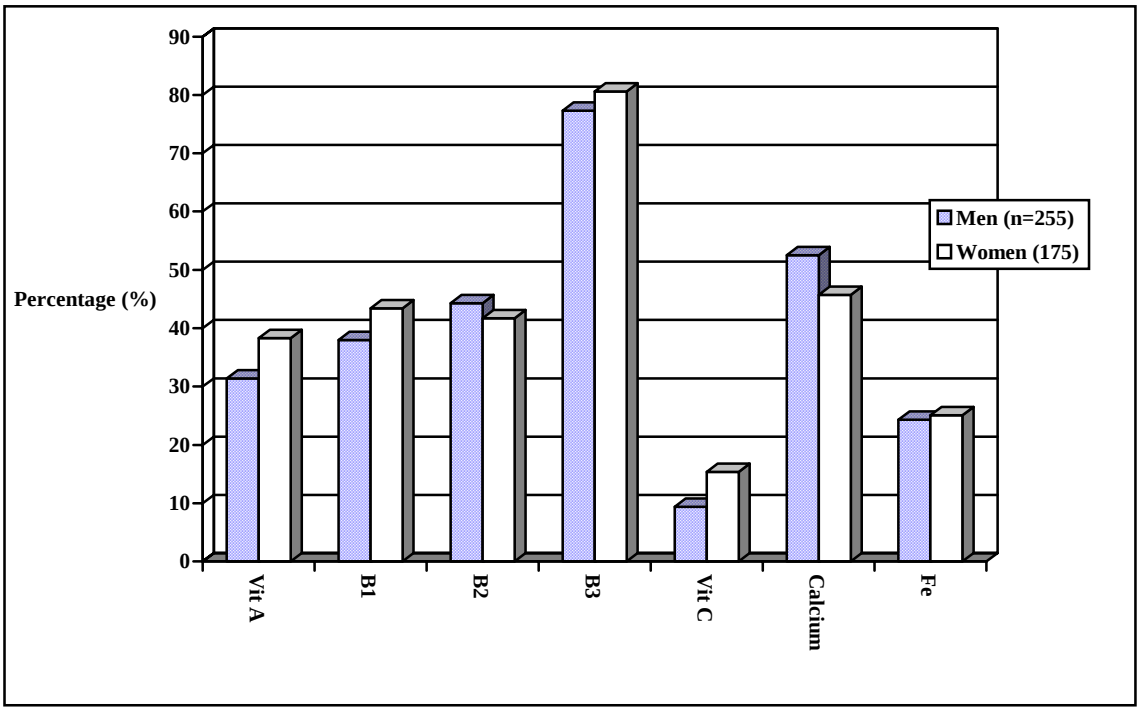

Figure 4. Percentage of subjects consuming <2/3 RNI of micronutrients

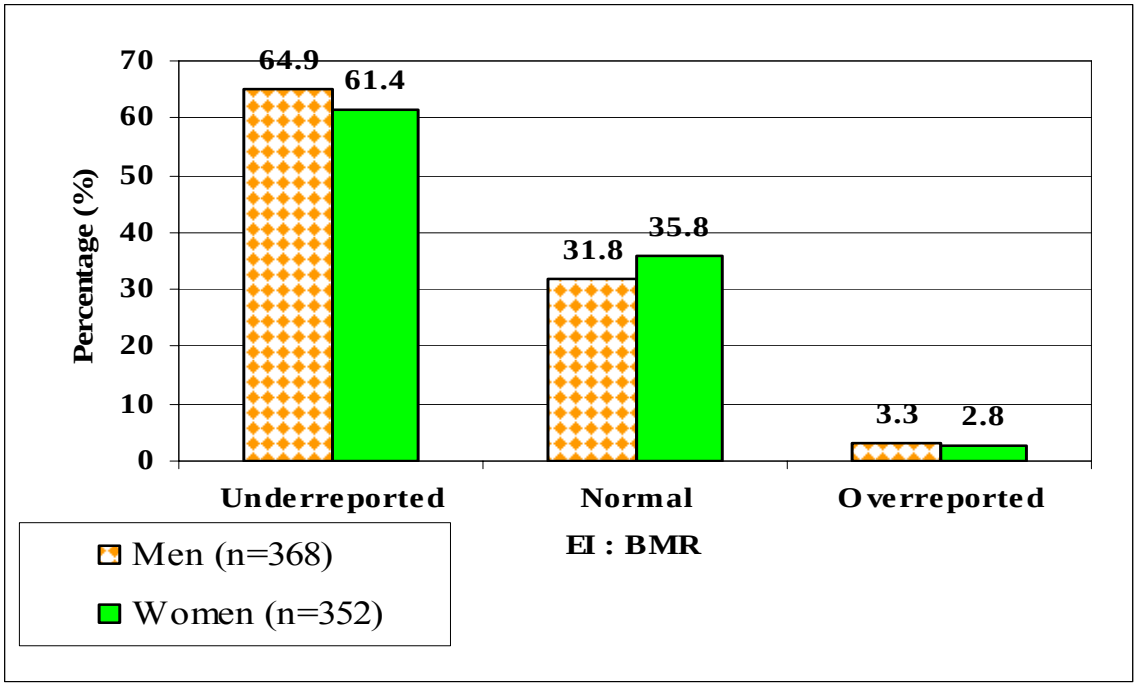

Figure 5. Percentage of subjects based on ratio of energy intake/ Basal Metabolic Rate (EI: BMR)

Nevertheless it is important to highlight that 64.9% men and 61.4% women in this study might have underreported their true intake (Fig 5) as estimated using the ratio of energy intake / Basal Metabolic Rate (EI : BMR) below than 1.20.[32] This latter finding might explain the high prevalence of abnormal lipid profiles with apparently inadequate dietary intakes. Yet again, the quality and composition of dietary fat among these elderly subjects needs further investigation, especially in regard to n-3 essential fatty acids and their protective role in cardiovascular disease. However, at the moment, the Malaysian Food Composition Tables only provide a limited list of foods with dietary fat composition. [36]

Conclusions

In conclusion, rural elderly Malays are rather heterogenous, facing both the risks of under and overnutrition, with older women at greatest risk. Substantial malnutri-

tion may exist in elderly persons with a so-called normal BMI or even in the obese by BMI criteria. On the other hand, low BMIs do relate to poor functional status. The high prevalence of dyslipidaemia among elderly Malays requires further investigation. There is a pressing need to identify early those at risk, for prevention of the effects of untreated malnutrition that can lead to morbidity, illness and reduced functional ability, and thus increase health care cost. Development of targeted nutrition and health education materials and also intervention programmes are required for this special population group.

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Original Article

A multidimensional assessment of nutritional and health status of rural elderly Malays

Suzana Shahar PhD[1], Zuriati Ibrahim MSc[1], Afaf Ruhi Abdul Fatah MSc[2], Suriah Abdul Rahman PhD[2], Noor Aini Mohd. Yusoff PhD[1], Fatimah Arshad PhD[1], Zaitun Yassin PhD[3] and Siti Nur 'Asyura Adznam BSc[1]

[1]*Department of Nutrition and Dietetics, Faculty of Allied Health Sciences, Universiti Kebangsaan Malaysia, Jalan Raja Muda Abdul Aziz, 50300 Kuala Lumpur*
[2]*Food Science Programme, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor*
[3]*Department of Nutrition and Dietetics, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Serdang, Selangor*

馬來西亞鄉村老人營養與健康狀況之多面向評估

營養與健康狀況的多面向評估包含主觀整體評估(SGA)、體位功能、生化、飲食攝取、社會及健康等面向，總共有 820 名(52.8%男性和 47.2%女性)來自於馬來西亞半島四個鄉村區域的老人完成此評估。研究對象被歸為體重過重或是慢性熱量缺乏的比例為 25.7%及 20.3%。雖然 49%的研究對象為正常體位，但有 68.4%依據 SGA 被歸為輕度到中度營養不良。分別只有 1.1%和 2.3%的人有低血清白蛋白及鐵蛋白。根據總膽固醇與 LDL-膽固醇的評估，大約 80%的研究對象其心血管疾病危險性高，尤其是男性。多數的研究對象的日常相關活動都可以完全獨立，男性的分數顯著性較女性高(p<0.001)。儘管如此，男性(50.7%)比起女性(27.0%)較少有能力去完成柔軟度測試(p<0.05)。男性(1412 ± 461 大卡/天)及女性(1201 ± 392 大卡/天) 的平均熱量攝取均低於馬來西亞的建議營養素攝取量(RNI)，雖然如此，我們還是無法斷言這個年齡組的人是否普遍熱量消耗降低。此外，52.5%的男性及 47.5%的女性低報食物攝取量。飲食中微量營養素最可能缺乏的為硫胺、核黃素及鈣質。總之，有相當數量的鄉村馬來老人有營養不良與營養過剩相關的問題。需要一個適當的營養介入系統，以改善馬來西亞鄉下老年人的營養狀況。

關鍵字：營養狀況、功能性狀態、食物攝取、老人、體位測量。