

## Prevalence of Malnutrition among Institutionalized Elderly People in Northern Peninsular Malaysia: Gender, Ethnicity and Age-specific

(Prevalens Malpemakanan dalam Kalangan Warga Emas di Institusi Penjagaan Orang Tua di Utara Semenanjung Malaysia: Jantina, Kaum dan Umur-spesifik)

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### ABSTRACT

*Evidence-based information on nutritional status of elderly people is essential for the formulation of health care system and prevents the elderly people from the risk of poor health and malnutrition. This cross-sectional study aimed to determine the prevalence of malnutrition among elderly people in Northern Peninsular Malaysia. A total of 236 participants (149 men and 87 women), aged 60 years and above, resided in government-funded shelter home were recruited. Anthropometric parameters of body weight, standing height, body mass index (BMI), mid upper arm circumference (MUAC) and waist circumference (WC) were measured and used as indices to assess malnutrition. The overall prevalence of underweight based on BMI <18.5 kg/m<sup>2</sup> was 17.4%. The prevalence of overweight based on BMI ≥25 kg/m<sup>2</sup> was 28.4%. Gender and ethnicity were significantly associated with malnutrition (p<0.05). Women were significantly more vulnerable to both underweight and overweight. Most Malays (37.7%) had overweight and obesity problems whereas more Indians (22.5%) were posed to greater risk of underweight. More women (32.2%) had high WC than men (4%) (p<0.05). A significantly declined trend of anthropometric measurements was observed among the elderly between age groups 60-69 years and ≥80 years. In conclusion, malnutrition and overweight coexisted among the institutionalized elderly people and this situation urged for specific interventional strategies and health policy formulation in order to reduce this double burden of disease.*

*Keywords: Body mass index; elderly; malnutrition; mid-upper arm circumference; waist circumference*

### ABSTRAK

*Maklumat yang tepat tentang status pemakanan warga emas boleh membantu dalam formulasi sistem kesihatan dan mengelakkan mereka daripada risiko kesihatan dan malpemakanan. Kajian keratan lintang ini bertujuan untuk menentukan prevalens malpemakanan warga emas di zon utara Semenanjung Malaysia. Seramai 236 orang peserta (149 lelaki dan 87 wanita), berumur 60 tahun ke atas, yang tinggal di institusi penjagaan orang tua awam telah dipilih. Ukuran berat badan, ketinggian, indeks jisim tubuh (BMI), lilitan pertengahan lengan atas (MUAC) dan ukur lilit pinggang (WC) dicatatkan. BMI, MUAC dan WC sebagai petunjuk untuk menentukan malpemakanan. Secara keseluruhannya, prevalens kekurangan berat badan yang berpandukan BMI <18.5 kg/m<sup>2</sup> adalah 17.4%. Manakala prevalens lebih berat badan berpandukan BMI ≥25 kg/m<sup>2</sup> pula mencatatkan 28.4%. Faktor jantina dan etnik mempunyai hubungkait yang signifikan dengan petunjuk malpemakanan (p<0.05). Golongan wanita mencatat peratusan yang lebih tinggi dalam kedua-dua aspek kurang dan lebihan berat badan. Kebanyakan kaum Melayu (37.7%) menghadapi masalah kegemukan manakala kebanyakan kaum India (22.5%) mengalami kurang berat badan. Lebih ramai wanita (32.2%) berbanding dengan lelaki (4%) yang mempunyai WC yang tinggi (p<0.05). Data juga menunjukkan bahawa ukuran antropometri warga emas pada umur ≥80 tahun adalah rendah berbanding dengan 60-69 tahun. Kesimpulannya, kedua-dua masalah malpemakanan dan lebih berat badan telah dicerap dalam kalangan warga emas di institusi tersebut. Perancangan intervensi dan formulasi polisi kesihatan amat diperlukan untuk mengurangkan kedua-dua bebanan kesihatan.*

*Kata kunci: Indeks jisim tubuh; lilitan pertengahan lengan atas; malpemakanan; ukur lilit pinggang; warga emas*

### INTRODUCTION

According to United Nations estimates, the world population of the elderly 60 years and above will achieve 1.2 billion by 2025, and the majority of them are in the developing countries (Arokiasamy 1997). Improvements in the quality of life and health care in developing countries, led to an increasing average of life expectancy, and thus increases the growth of elderly population (Cho et al. 2004;

Gavazzi et al. 2004; Jitapunkul et al. 2003; Shahar et al. 2001). Moreover, fertility decline also contributes to this aging phenomenon (Arokiasamy 1997). The increasing elderly population would develop various health and nutritional problems, and this requires increasing health and social costs in providing facilities and rehabilitation services especially for the poor developing countries (Chilima & Ismail 1998; Cho et al. 2004; Gavazzi et al.

2004; Jitapunkul et al. 2003; Shahar et al. 2001; Suzana et al. 2002).

The age determination used to define 'elderly' varies among researchers. However, the United Nations World Assembly On Ageing held in Vienna 1982, used '60 years and over' as the age cut-off to refer to the elderly people. Besides, Malaysian policy makers have also adopted this demarcation and are officially used in planning for the elderly (Rabieyah Mat & Hajar Md. Taha 2003). Hence, this study had used the same cut-off value.

'Rumah Seri Kenangan (RSK)' are government-funded shelter homes for the elderly. Unlike nursing home, the residents in RSK are more independent. RSK provides care and support to elderly people who lack family and financial support. It is likely that the prevalence of under-nutrition will be high because the elderly people have often lived an impoverished and lonely life prior to admission and a large percentage of them originated from rural villages (Vishvanathan et al. 2005). The elderly are physiologically vulnerable to the risk of malnutrition. Furthermore, social isolation and poverty are known to be associated with nutritional risk among them (Vishvanathan 2003).

Malnutrition can be due to various factors such as the changes in their body physically and physiologically as a part of aging; psychosocial and environment factor; income and food accessibility and others. Malnutrition has been defined as "a pathological state resulting from a relative or absolute deficiency or excess of one or more essential nutrients". It can comprise four aspects – under-nutrition, over-nutrition, imbalance and specific deficiency (Park 2000). The elderly people are susceptible to the risk of under-nutrition which includes protein-energy malnutrition and micronutrient deficiency. In spite of this, problems of overweight and obesity among this group cannot be neglected. Food consumption and physical inactivity have led to a rising prevalence of overweight and obesity in men and women (Park 2000).

In order to manage and prevent the deterioration of the health and well being among the elderly as they are the population which has the increasing growth, nutritional assessment is indeed important to be carried out. Anthropometric measurements are regarded as important indicators of an individual's nutritional status. Anthropometry is a simple, practical, low-cost, non-invasive, reliable, and widely accepted tool used to assess nutritional status and to provide information on muscle mass and stored fat (Vellas et al. 2001; Whitehead & Finucane 1997). Regular anthropometric measurements can serve as the guide to monitor the appropriateness of nutritional therapy (Suriah et al. 1998) and the adequacy of health programs.

In Malaysia, the number of elderly almost doubled over the twenty years from 1970-1991 from 546000 in 1970 to 1.03 million. The numbers have increased by another 35 per cent over the last 10 years to 1.4 million persons or 6.3 per cent of the total population in 2000. Based on population projections, the number of elderly is likely to more than double to 3.4 million in 2020

(Rabieyah Mat & Hajar Md. Taha 2003). As compared to the developed countries, the proportion of elderly in Malaysia is still small; however, the increase in absolute numbers of older people in Malaysia resulted in higher rate of increment for the elderly age group than the other age group, this implies the need to address the numerous problems faced by the elderly group, including health (Arokiasamy 1999). This also highlights the need to plan for a variety of health care systems and programs to meet the special needs of the elderly.

Presently, the extent of nutritional status among elderly people in these RSK is limited. Therefore, the aim of this study was to determine the prevalence of malnutrition among elderly people in government-funded shelter homes in Northern Peninsular Malaysia.

## SUBJECTS AND METHODS

This cross-sectional study was conducted from April to May 2010 in the northern region of Peninsular Malaysia. The study location comprises RSK Kangar (Perlis), RSK Betong (Kedah), RSK Taiping (Perak) and RSK Pengkalan Chepa (Kelantan). Selection of these four RSK was based on the most number of residents in the RSK who aged 60 years and above. The participants were recruited using purposive sampling technique. Other inclusion criteria for this study were those who had no oedema (noticeable swelling of any part of the body due to accumulation of excessive amount of watery fluid in cells), no kyphosis (abnormal curvature of the spine causing hunchback), those who were not terminally ill or bed ridden and able to communicate well.

This study was approved by the Department of Social Welfare, Malaysia and ethical approval was obtained from The Research Ethics Committee (Human), Universiti Sains Malaysia. Participants were explained the purpose and procedure of anthropometric measurement and informed consent were obtained from the participants.

Three trained field workers conducted the interviews and the anthropometric measurements. Participants were interviewed on socio-demographic information using questionnaire. Data such as age, gender, ethnicity, marital status, literacy, and smoking status were obtained.

Anthropometric measurements were taken using standard techniques. Height was measured using portable height stadiometer (SECA bodymeter 206). Participant was told to be barefoot, legs straight, shoulders relaxed and to look straight ahead at the horizontal plane (Robert & David 2007). Participant was asked to inhale deeply, hold the breath and maintain an erect position just before taking the measurement. Reading of height measurement was taken twice to the nearest 0.1 cm. The weight was measured with a portable electronic weighing scale (SECA model 881). Participant was informed to wear minimum clothing and stand still in the middle of the scale's platform. Reading of weight was taken twice to the nearest 0.1 kg. The body mass index (BMI) was derived using equation: weight in kilogram divided by height in meter square; BMI

= weight (kg) / height (m)<sup>2</sup> BMI categorization was defined as underweight with BMI <18.5 kg/m<sup>2</sup>; normal with BMI 18.5-24.9 kg/m<sup>2</sup>; overweight with BMI 25.0-29.9 kg/m<sup>2</sup>; and obese with BMI ≥30 kg/m<sup>2</sup> (Ministry of Health Malaysia 2003; WHO 2006).

Mid upper arm circumference (MUAC) was measured with the participant standing and relaxing his arm to the side with the palm of the hand facing the thigh. A non-stretchable measuring tape was placed around the arm, perpendicular to the long axis of the arm, and at the level of the triceps skinfold site (which is located midway between the lateral projection of the acromion process of the scapula and the olecranon process of the ulna, with the elbow flexed 90 degrees) (Robert & David 2007). For the measurement of waist circumference, the field workers first located the participant's right iliac crest using fingertips to feel the highest point of hip bone, then placed an inelastic, flexible tape at a horizontal plane around the abdomen at the level of the located highest point. The participant was told to stand erectly and to relax abdominal muscles. Reading for both MUAC and WC was taken twice at the end of a normal expiration to the nearest 0.1 cm (Robert & David 2007).

Anthropometric indices of BMI (<18.5 kg/m<sup>2</sup>) and MUAC (<22cm for women and <23 cm for men), were used to predict under-nutrition; whereas BMI ≥25 kg/m<sup>2</sup> and WC (≥88 cm for women and ≥102 cm for men), were the indicators for over-nutrition.

Data were analysed using SPSS (Statistical Package for Social Sciences) version 18. Independent sample t-test was used to examine differences among continuous anthropometric data. The Chi-square test was carried out to determine the association between malnutrition (under-nutrition and over-nutrition) indicators and socio-demographic characteristics (e.g. gender, age group, ethnicity, marital, literacy and smoking status). Analysis of variance (Anova) with Bonferroni procedures was used to test for differences in mean body weight, height, BMI, MUAC and WC across age groups for both gender. The level of significance used was  $p < 0.05$  for all the statistical tests.

## RESULTS

A total of 236 participants were recruited, 63.1% were men and 36.9% were women (Table 1). Majority of the participants were Malays (45%), followed by 38.1% of Chinese and 16.9% of Indians. The age of the participants ranged from 60 to 97 years with mean age of 71.6±7.4 years for men and 72.4±8.1 years for women. Table 1 presents the socio-demographic characteristics of the participants.

There were gender differences in body weight and standing height. Elderly men had greater mean body weight (57.2±11.1 kg) than women (50.0±11.5 kg) ( $p < 0.05$ ). Men were also taller (160.1±6.3 cm) than women (146.2±6.5 cm) ( $p < 0.05$ ). Mean BMI, MUAC and WC for men and women were in normal categories, respectively.

Majority of the participants (54.2%) had a normal BMI range. The overall prevalence of underweight based on BMI <18.5 kg/m<sup>2</sup> (WHO 2006) was 17.4% (15.4% among men and 20.7% among women) (Figure 1). On the other hand, the prevalence of overweight based on BMI ≥25 kg/m<sup>2</sup> was 28.4% (24.2% among men and 35.6% among women). Figure 2 shows that Indians (22.5%) experienced greater underweight than Malays (17.0%) and Chinese (15.6%) whereas Malays had the highest proportion (37.7%) of overweight among the three ethnics.

Table 2 presents the association between malnutrition and socio-demographic characteristics. Gender and ethnicity were significantly associated with malnutrition (based on BMI categorization of underweight and overweight). There was a higher proportion of women who were both underweight and overweight than men ( $p < 0.05$ ). Indians and Malays had the highest proportion of underweight and overweight, respectively ( $p < 0.05$ ). A total of 32.2% women had increased risk of health problems and had abdominal obesity as compared to only 4% among men ( $p < 0.05$ ). Results also showed that those elderly who were literate were less likely to experience muscle wasting ( $p < 0.05$ ).

As for comparison between age group, of the total participants ( $n = 236$ ), means and standard deviations (SDs) for body weight, standing height, BMI, MUAC and WC were significantly lower for age group ≥80 years as compared to younger age 60-69 years ( $p < 0.05$ ). No significant results noticed when comparison was made between age group 60-69 years and 70-79 years and also between 70-79 years and ≥80 years. For men, there were significantly lower values for anthropometric measurements of body weight, standing height, BMI and MUAC for older group (≥80 years) as compared to age group 60-69 years ( $p < 0.05$ ) (Table 3). However, age-related differences were not statistically significant for all variables for women.

## DISCUSSION

### PREVALENCE OF MALNUTRITION

In this study, the overall prevalence of under-nutrition was 17.4% among the elderly as defined by BMI less than 18.5 kg/m<sup>2</sup>. As reported by Vishanathan et al. (2005), a large proportion of elderly people in these shelter homes were originated from rural communities, and were poorly educated and at risk of under-nutrition. Rural elderly Malaysians with no steady financial support and uneducated were at high risk of under-nutrition (Shahar et al. 2001). Interestingly, when compared to the study of Vishanathan et al. (2005), there was no improvement observed in the percentage of under-nutrition in these shelter homes in current study (14.3 vs 17.4%) in this 8-year period even though regular and nutritious meals and health care facilities were provided in the shelter homes. The reasons to this phenomenon might be the residents with rural origin had been suffering from long term under-

TABLE 1. Socio-demographic characteristics and anthropometric measurements according to gender (presented as number (%) or mean±SD and p)

Characteristics	Men (n=149) n(%), mean±SD	Women (n=87) n(%), mean±SD
Age(years)	71.6±7.4	72.4±8.1
Age group(years)		
60-69	62(41.6)	33(37.9)
70-79	63(42.3)	34(39.1)
≥80	24(16.1)	20(23.0)
Ethnicity		
Malay	63(42.3)	43(49.4)
Chinese	59(39.6)	31(35.6)
Indian	27(18.1)	13(14.9)
Marital status**		
Single	67(45.0)	22(25.3)
Married	33(22.1)	5(5.7)
Divorced	9(6.0)	9(10.3)
Widowed	40(26.8)	51(58.6)
Literacy**		
Literate	116(77.9)	42(48.3)
Illiterate	33(22.1)	45(51.7)
Smoking status**		
Current smoker	73(49.0)	4(4.6)
Ex-smoker	24(16.1)	5(5.7)
Non-smoker	52(34.9)	78(89.7)
Anthropometric measurements		
Weight(kg)*	57.2±11.1	50.0±11.5
Standing height(cm)*	160.1±6.3	146.2±6.5
Body mass index(kg/m <sup>2</sup> )	22.3±4.0	23.5±5.5
Mid upper arm circumference(cm)	27.0±3.6	26.9±4.7
Waist circumference (cm)	82.7±10.9	81.4±12.3

\*p<0.05, independent t-test

\*\* p<0.05, Pearson Chi-square test

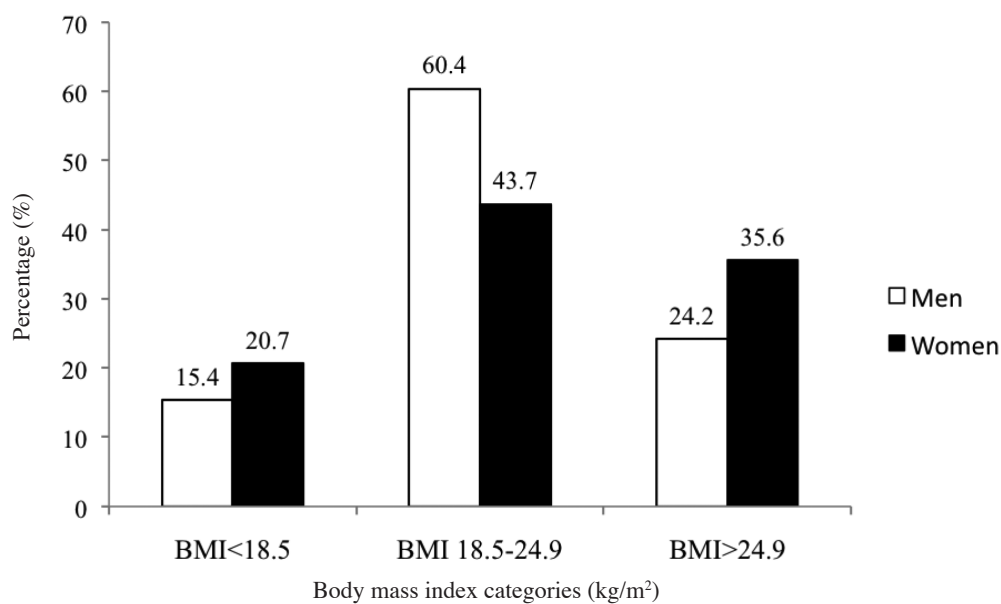


FIGURE 1. Prevalence of malnutrition according to BMI categories and gender

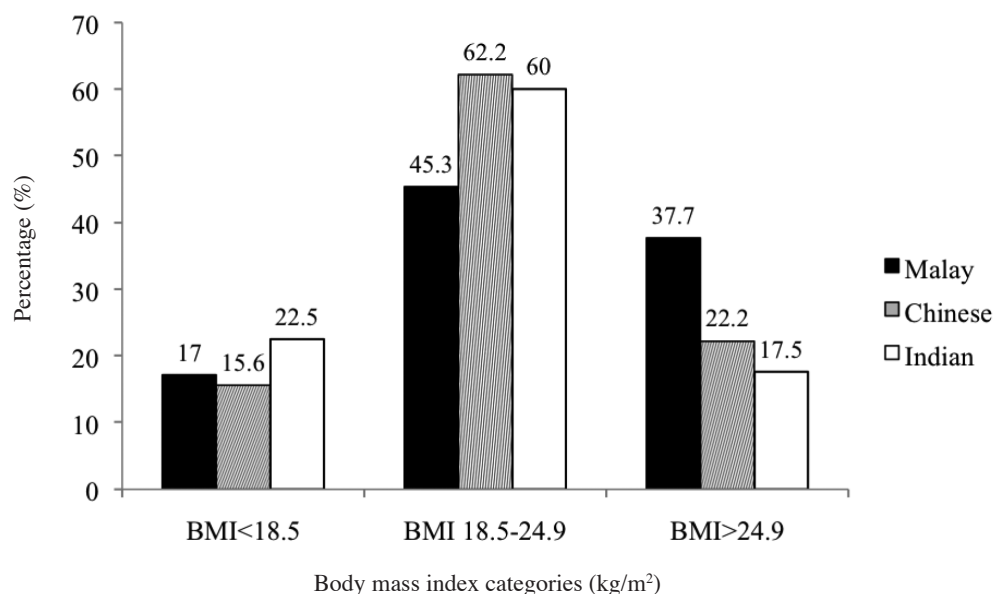


FIGURE 2. Prevalence of malnutrition according to BMI categories and ethnicity

TABLE 2. Association between malnutrition and socio-demographic characteristics (presented as number (%) and p)

Characteristics	n	Malnutrition			
		Undernutrition		Overnutrition	
		BMI <18.5 kg/m <sup>2</sup>	MUAC (M<23 cm, W<22 cm)	BMI ≥25 kg/m <sup>2</sup>	WC (M≥102cm, W≥88cm)
<b>Gender</b>					
Men	149	23(15.4) *	17(11.4)	36(24.2) *	6(4.0) *
Women	87	18(20.7)	11(12.6)	31(35.6)	28(32.2)
<b>Age-group(years)</b>					
60-69	95	14(14.7)	8(8.4)	33(34.7)	18(18.9)
70-79	97	16(16.5)	11(11.3)	27(27.8)	12(12.4)
≥80	44	11(25.0)	9(20.5)	7(15.9)	4(9.1)
<b>Ethnicity</b>					
Malay	106	18(17.0) *	7(6.6)	40(37.7) *	18(17.0)
Chinese	90	14(15.6)	13(14.4)	20(22.2)	11(12.2)
Indian	40	9(22.5)	8(20.0)	7(17.5)	5(12.5)
<b>Marital status</b>					
Single	89	21(23.6)	15(16.9)	16(18.0)	5(5.6)
Married	38	3(7.9)	12.6	15(39.5)	5(13.2)
Divorced	18	2(11.1)	2(11.1)	7(38.9)	3(16.7)
Widowed	91	15(16.5)	10(1.0)	29(31.9)	21(23.1)
<b>Literacy</b>					
Literate	158	26(16.5)	14(8.9) *	46(29.1)	20(12.7)
Illiterate	78	15(19.2)	14(17.9)	21(26.9)	14(17.9)
<b>Smoking status</b>					
Current smoker	77	11(14.3)	10(13.0)	15(19.8)	3(3.9)
Ex-smoker	29	3(10.3)	2(6.9)	9(31.0)	3(10.3)
Non-smoker	130	27(20.8)	16(12.3)	43(33.1)	28(21.5)

\*p<0.05, Pearson Chi-square test

BMI- Body mass index; MUAC- Mid upper arm circumference; WC- Waist circumference; M- Men; W- Women

nourishment which was difficult to be corrected; they were already used to their previous rural lifestyle and food habits; loneliness and social isolation could also contribute to this problem.

On the other hand, this study also presented the prevalence of almost one-third of the residents in government-funded shelter homes, who were overweight (BMI  $\geq 25$  kg/m<sup>2</sup>). This finding was in agreement with a recent study done in rural villages in northern Malaysia that reported 36.7% of free-living elderly (60 years above) were overweight (Narayan & Abdul Rashid Khan 2007). The above results on high prevalence for both under-nutrition and over-nutrition showed that Malaysian elderly from shelter homes were suffering from this double burden of disease.

#### ASSOCIATION BETWEEN MALNUTRITION AND SOCIO-DEMOGRAPHIC CHARACTERISTICS

There were significant association of malnutrition with gender and ethnicity, as assessed by BMI less than 18.5 kg/m<sup>2</sup> for under-nutrition and BMI more than 25 kg/m<sup>2</sup> for over-nutrition, respectively. The significant higher proportion of institutionalized elderly women, for both BMI categories of underweight (20.7%) and overweight (35.6%) was a matter of concern. This indicated that elderly women were more vulnerable to malnutrition as compared to men, as supported by other studies (Tsai et al. 2007; Vishanathan et al. 2005). Lack of educational and employment opportunities, low involvement rates in the social activities (Shahar et al. 2001) and gender roles among rural women limit them from exposure to basic health information. These can lead to increased rate of malnutrition in older age. When compared between ethnicity, elderly Indians (22.5%) were more vulnerable to underweight whereas almost 40% of elderly Malays had overweight and obesity problem, which was the highest among the three ethnics. Rosnah et al. (2009) also reported the same finding that around 60% elderly Malays had over-nutrition problems than non-Malays. Unhealthy lifestyle including culturally high fat and cholesterol diet might be the reason that causes the Malays to have greater health risks but this need to be studied further. Underweight as well as overweight in old age are associated with morbidity that can impair the overall quality of life. Detailed investigation on dietary habits, lifestyle, socio-economic status before admission to shelter homes; as well as medical and physical activity history are indeed required to identify the factors contributing to such phenomena in order to provide evidence-based information for the planning of health programs for the elderly population.

Gender was also significantly associated with over-nutrition, as assessed by waist circumference (WC) value of  $\geq 88$  cm for women and  $\geq 102$  cm for men. There was a relatively higher percentage of elderly women in shelter homes (32.2%) who had high WC as compared to men (4%). This indicated that elderly women had increased

risk of health problems and abdominal obesity than men. In the shelter homes, women were observed to be less physically active than men, women used to rest at their bed whereas men would like to involve in cleaning activities as reported by the RSK staffs. Abdominal fat depots can be due to a combination of physical inactivity and the decline of metabolic rate with aging. Physiological condition such as parity (Gunderson et al. 2008) and menopausal estrogen deficiency in elderly women are also associated with an increase in fat mass and a redistribution of fat to abdominal area (Toth et al. 2000).

Literacy was significantly associated with under-nutrition, as assessed by mid upper arm circumference (MUAC) value of less than 22 cm for women and less than 23 cm for men. Subjects who were literate were less likely to experience muscle wasting. It is postulated that they were able to read and can be exposed to at least basic health and food information that influence their food choices. Further investigation need to be done on this.

#### ANTHROPOMETRIC MEASUREMENTS ACCORDING TO GENDER AND AGE GROUP

This study showed a declined trend of anthropometric measurements as age increases for both gender (Table 3). The significant decrease in mean weight of elderly men from 60.1 kg at the age of 60 to 69 years to 51.5 kg at age  $\geq 80$  years, demonstrated a higher percentage of reduction (14.3%) as compared to elderly women (12.1%) at the corresponding age group. This result was in contrast to the findings of Suriah et al. (1998) that the decline was greater among elderly women (16.3%) as compared to men (8.9%). Decline in body weight among elderly individuals can occur due to the reduction of total body water and muscle mass (Nair 2005). Other reasons contributed to this condition can be social, health care, personal morbidity, availability and accessibility issues.

Same trend was observed for standing height but the percentage of decrease was very small between age group 60 to 69 years and  $\geq 80$  years for men (2.4%) and women (1.2%). Age-related height loss is more reasonably interpreted as due to cohort effect; younger cohorts attain better growth potential because of better nutrition than older cohorts (Lim et al. 2000). Obtaining an accurate height measurement can be difficult since many non-kyphotic elderly people may have problems standing upright and this will eventually overestimate the BMI. In this study, we had try to minimize this measurement error by giving accurate instructions to the elderly such as deep inhalation and holding breath to maintain erect position when reading was taken.

The BMI decreased significantly for men at age  $\geq 80$  years than at younger age group (60-69 years), showing a reduction of about 3 kg/m<sup>2</sup> over two decades. According to Lim et al. (2000), decrease in BMI with age should not be interpreted as due to aging process, an alternative explanation given is selective survival, which is people with lower BMI tend to survive with increasing age thus shifting the BMI distribution of survivors downwards.

TABLE 3. Anthropometric measurements according to gender and age group (presented as mean±SD and p)

Variables(unit)	Men (n=149)	Women (n=87)
Age group(years)	mean±SD	mean±SD
Weight(kg)		
60-69	60.1±12.9 <sup>a</sup>	52.9±11.9 <sup>a</sup>
70-79	56.4±9.4 <sup>ab</sup>	49.4±11.9 <sup>a</sup>
≥80	51.5±7.6 <sup>b</sup>	46.5±9.4 <sup>a</sup>
Standing height(cm)		
60-69	161.7±6.8 <sup>a</sup>	146.8±7.5 <sup>a</sup>
70-79	159.3±5.9 <sup>ab</sup>	146.3±5.5 <sup>a</sup>
≥80	157.9±5.3 <sup>b</sup>	145.0±6.4 <sup>a</sup>
Body mass index(kg/m <sup>2</sup> )		
60-69	23.0±4.5 <sup>a</sup>	24.6±5.8 <sup>a</sup>
70-79	22.2±3.6 <sup>ab</sup>	23.1±5.8 <sup>a</sup>
≥80	20.6±2.9 <sup>b</sup>	22.1±4.2 <sup>a</sup>
Mid upper arm circumference(cm)		
60-69	27.8±3.9 <sup>a</sup>	28.5±4.7 <sup>a</sup>
70-79	26.8±3.2 <sup>ab</sup>	26.0±4.8 <sup>a</sup>
≥80	25.5±3.2 <sup>b</sup>	25.8±4.2 <sup>a</sup>
Waist circumference(cm)		
60-69	84.1±12.4 <sup>a</sup>	83.8±13.0 <sup>a</sup>
70-79	82.7±9.6 <sup>a</sup>	80.9±13.3 <sup>a</sup>
≥80	79.2±9.1 <sup>a</sup>	78.5±9.0 <sup>a</sup>

<sup>a,b</sup> For the same variable, mean values with different superscript letters were significantly different (Anova, post-hoc test by Bonferroni procedures; significant level at p<0.05)

Besides, a significant reduction of about 2cm for MUAC was observed between age groups 60-69 years and ≥80 years in men. MUAC reduction could be due to loss of fat and lean body mass associated with aging (Lipski et al. 1993). Decrease in muscle mass with age is believed to contribute to decreased muscle strength which can affect nutritional status by impeding participation in food production, acquisition, preparation and in socialization at meals (Kikafunda & Lukwago 2005).

There are some limitations in this study. Data on socio-economic status, dietary intake, biochemical parameters, physical activity, and specific disease condition need to be obtained in order to produce more information on nutritional status among institutionalized elderly people. Study location should include all Rumah Seri Kenangan (government-funded shelter homes) in Peninsular Malaysia so that the results obtained would be more representative. As this study was cross-sectional in design, thus the observed age-related decrement could have been confounded by other variables, secular changes as well as cohort effect.

#### CONCLUSION

The present study clearly demonstrated the association of malnutrition with certain socio-demographic characteristics. Almost 20% of the participants were under-nourished but also another one-third of them were overweight and obese. Both of these conditions may affect the overall well being.

Hence, this information is important for the planning of prevention or interventional strategies as well as the formulation of health policy to reduce this double burden of disease among elderly people.

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