

Original Article

Good oral health, adequate nutrient consumption and family support are associated with a reduced risk of being underweight amongst older Malaysian residents of publicly funded shelter homes

Renuka Visvanathan FRACP, MBBS, PhD¹ and Zaiton Ahmad MMed, MD²

¹ Department of Medicine, The University of Adelaide and Director, Aged and Extended Care Service, The Queen Elizabeth Hospital, South Australia, Australia

² Institute of Gerontology, University Putra Malaysia and Department of Community Health, University Putra Malaysia, Serdang, Malaysia

A low body mass index in older people has been associated with increased mortality. The main objective of this study was to identify factors associated with low body mass indices [BMIs] (< 18.5 kg/m²) in older residents of shelter care facilities in Peninsular Malaysia. 1081 elderly people (59%M) over the age of 60 years were surveyed using questionnaires determining baseline demographics, nutritional and cognitive status, physical function and psychological well being. Body mass index was also determined. Subjects were recruited from publicly funded shelter homes in Peninsular Malaysia. 14.3% of residents had BMIs < 18.5 kg/m². Multivariate analyses (adjusted for age and sex) revealed that having no family (RR 1.98 [95%CI 1.40-2.82], *P*<0.001) and negative responses to statement 3 [I eat few fruits or vegetables or milk products] (RR 0.62 [95% CI 0.42-0.90]; *P*=0.013) and statement 5 [I have tooth or mouth problems that make it hard for me to eat] (RR 0.69 [95%CI 0.50-0.96]; *P*=0.023) of the 'Determine Your Nutritional Health Checklist' were independently associated with low BMIs (<18.5 kg/m²). Older people with no family support were at risk of becoming underweight. Older people who consumed fruits, vegetables or milk or had good oral health were less likely to be underweight. Nutrient intake, oral health and social support were important in ensuring healthy body weight in older Malaysians.

Key Words: Body mass index, oral health, nutrition, social support, poverty, homeless, elderly, shelter homes, Malaysia.

Introduction

In Malaysia, many older people who do not have family or financial support are housed in publicly funded shelter homes. There are nine such shelter homes ('Rumah Seri Kenangan) in Peninsular Malaysia, which provide social and rehabilitative support. Prior to this study, the health status of these older residents was not known. As the elderly residents in these homes are financially disadvantaged, most of them are dependant on the meals, clothes and medications provided to them at these homes.

One Malaysian study found that approximately 40% of older Malay residents (one ethnic group) of a rural village in Peninsular Malaysia were underweight with a body mass index (BMI) < 18.5 kg/m² (Suzana *et al.*, 2002).¹ Therefore, there was a high likelihood that a large proportion of residents in these shelter homes would be at risk of being underweight. BMI is often used as an anthropometric measure in the assessment of nutritional status (Visvanathan *et al.*, 2005, Visvanathan *et al.*, 2004).^{2,3} Several studies have shown that Asian populations when compared with Caucasian/European populations, have a higher body fat percent at similar BMI (Wang *et al.*, 1994, Ministry of

Health Malaysia, 2003, Deurenberg *et al.*, 2002).⁴⁻⁶ For this reason, in Malaysia, the healthy BMI range for adult Malaysians has been determined to be between 18.5 and 22.9 kg/m² (Ministry of Health Malaysia, 2003).⁵ A BMI <18.5 kg/m² is associated with increased mortality risk relative to healthier BMI in older people (Flegal *et al.*, 2005, Taylor and Ostbye, 2001).^{7,8}

Studies in Asians have also found that low body mass indices (BMIs- < 18.5 kg/m²) in adults are associated with illnesses and reduced work performance (Shetty and James, 1994).⁹ This poor health is partly because, older people

Correspondence address: Renuka Visvanathan, Department of Medicine, The University of Adelaide and Director, Aged and Extended Care Service, The Queen Elizabeth Hospital, 28 Woodville Road, Woodville South 5011, South Australia, Australia

Tel: + 61-8-8222 6887; Fax: + 61-8-8222 6042

Email: renuka.visvanathan@adelaide.edu.au

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people with low BMI, are likely to have a lack of lean mass (sarcopenia) and this is associated with poor health outcomes (Janssen *et al.*, 2002).¹⁰ It is therefore important to identify underweight older people and institute remedial strategies early. The primary aim of this study was to determine the factors independently associated with low BMIs (defined as $<18.5 \text{ kg/m}^2$).

Materials and methods

The study methodology has been described in detail elsewhere but is described briefly here (Visvanathan *et al.*, 2005).² Two research assistants interviewed 1081 residents using questionnaires that had been translated into the official written and spoken Malaysian language (Bahasa Malaysia). One investigator (ZA) trained both research assistants. One investigator (ZA) translated the questionnaires whilst a second investigator (RV) verified its accuracy. Subjects who were younger than 60 years old and had resided in the shelter homes for less than three months were excluded. In total, between March and September 2003 there were a total of 1341 residents in these shelter homes but only 1126 residents were eligible to participate in this study. Of the 1126 residents approached, 45 did not participate due to poor health or severe dementia. Socio-demographic, body mass index (BMI), health (the presence of diabetes, stroke, ischemic heart disease, hypertension and osteoarthritis), nutritional (DETERMINE Your Nutritional Health Checklist), emotional (GDS-12R) and cognitive (ECAQ) status and physical function (Barthel's Index) were determined. Informed consent was obtained from all 1081 subjects and/or their carers (participation rate 96%). The study was performed under the auspices of the Department of Social Welfare, Malaysia. Ethics approval was obtained from the human research ethics committee of University Putra Malaysia.

Body mass index

Weight was measured using the same portable weighing scale (TANITA weighing scale) in light clothing (without shoes) to the nearest 0.1kg. Height (SECA body meter) was measured whilst the patient was standing to the nearest 0.5cm. BMI was calculated as weight in kilogram divided by height in meters squared. Subjects scoring less than 18.5 kg/m^2 were said to be underweight in this study.

Nutritional status

The 'DETERMINE Your Nutritional Health Checklist' [NHC] (maximum score 21) is a simple questionnaire of 10 statements on a single page requiring yes/no answers (Omran and Morley, 2000).¹¹ Statement [S] 1- I have an illness or condition that made me change the kind and/or amount of food that I eat (score 2); S2- I eat fewer than two meals per day (score 3); S3- I eat few fruits or vegetables or milk products (score 2); S4- I have 3 or more drinks of beer, liquor or wine almost every day (score 2); S5- I have tooth or mouth problems that make it hard for me to eat (score 2); S6- I don't always have enough money to buy the food I need (score 4); S7- I eat alone most of the time (score 1); S8- I take 3 or more different prescribed or over-the-counter drugs a day (score 1); S9- Without wanting to, I have lost or gained 10

pounds in the last 6 months (score 1); S10- I am not always physically able to shop, cook and/or feed myself (score 2). In this study, subjects scoring 3 or more were considered to be at nutritional risk (AR) [3-5 moderate risk, >6 high risk].

Cognition

The Elderly Cognitive Assessment Questionnaire (ECAQ) was developed specifically for use among elderly people in developing countries and was used to evaluate cognitive status in this study (Kua and Ko, 1992).¹² The questionnaire consists of 10 items grouped under 3 categories: memory (3 items), orientation (6 items) and memory recall (1 item). Subjects were classified in this study as experiencing probable (<5), borderline (5-6) and no (>6) cognitive impairment [max score 10].

Physical function

Ability to independently perform activities of daily living (ADL) was assessed using the 10-item modified Barthel Index. It has a maximum score of 20 and subjects were classified according to their scores; 'moderately to very severely disabled' (≤ 14), 'mildly disabled' (15 to 19) and 'fully independent' (20) (Tornquist *et al.*, 1990).¹³

Depression

The 12 question Geriatric Depression Scale for people in residential care facilities (GDS-12R) was used to diagnose depression in this study (Sutcliffe *et al.*, 2000).¹⁴ Developed from the GDS-15, 3 items found to be poor identifiers of depression in nursing and residential home populations were excluded: 1) the preference of going out rather than staying home; 2) the feeling of having more problems than other people; and 3) the feeling that most people were better off than them (Sutcliffe *et al.*, 2000).¹⁴ In this study, subjects scoring of >5 (maximum score of 12) were at risk of depression (Sutcliffe *et al.*, 2000).¹⁴

Statistical Analysis

Log-binomial regression univariate analysis of subject's clinical characteristic based on low BMI ($<18.5 \text{ kg/m}^2$) was performed. Factors associated with this low BMI ($P \leq 0.12$ by univariate analysis) were then included into a log-binomial regression multivariate analysis adjusting for age and sex yielding factors independently associated with low BMIs. We did not adjust for socio-economic status as people in these homes were poor and financially dependant on the financial support provided to them by these homes (i.e. minimal). SAS was the software program used (SAS Institute, inc, Cary, NC). P values <0.05 were considered to be statistically significant.

Results

The socio-demographic profile of this study population has been described elsewhere (Visvanathan *et al.*, 2005).² 14.3% of the older people living in these shelter accommodation were underweight with a BMI $<18.5 \text{ kg/m}^2$ (Visvanathan *et al.*, 2005).² The BMI was not determined in 102 people as 93 were too physically dependent and nine others declined. There was no difference in terms of age ($72 + 7.6[\text{SD}]$ vs. $73 + 7.2$; $P=0.19$) and gender (58.5% vs. 58.8%; $P=1.0$) between those who had

their BMI determined and those who did not.

Table 1 shows the results of the univariate log-binomial regression analysis of subjects' clinical characteristics, based on the baseline BMI. Subjects were grouped as not underweight ($BMI \geq 18.5 \text{ kg/m}^2$) and underweight ($BMI < 18.5 \text{ kg/m}^2$). Seventeen parameters were found to be potentially associated with ($P < 0.12$) being underweight. These parameters were further evaluated in a multivariate log-binomial regression analysis [adjusted for age and sex]. The following parameters were not evaluated: 1) the nutritional score and nutritional status as individual statements from the NHC were included into the analysis; 2) sex as the analyses was subsequently adjusted for this; and 3) statement 8 on the NHC as the number of medications determined using the medical records was more accurate and this was included into the analysis instead.

Having no family (RR 1.98 [95%CI 1.40-2.82], $P < 0.001$) was associated with increased risk of being under-weight. Negative responses to statement 3 [I eat few fruits or vegetables or milk products] (RR 0.62 [95% CI 0.42-0.90]; $P = 0.013$) and statement 5 [I have tooth or mouth problems that make it hard for me to eat] (RR 0.69 [95%CI 0.50-0.96]; $P = 0.023$) of the NHC appeared to be protectively associated with a lower BMI.

Discussion

This study confirms for the first time in Malaysia that a large proportion (14.3%) of older people residing in these publicly funded shelter homes are underweight and have BMIs that are less than 18.5 kg/m^2 (Visvanathan *et al.*, 2005).² Having no family was found to be independently associated with an increased risk of having a low BMI whilst denial of reduced fruits, vegetables or milk consumption and poor oral and dental health was shown to be associated with a reduced risk of being under-weight ($BMI < 18.5 \text{ kg/m}^2$).

In contrast to a previous study where almost 40% of rural subjects were underweight ($BMI < 18.5 \text{ kg/m}^2$), only 14% of shelter home residents in this study were underweight (Suzana *et al.*, 2002).¹ That study only investigated Malay subjects whilst our study involved all the three major racial groups in Malaysia but this was unlikely to be the reason for the difference seen (total underweight 14%, Malays 12.8%, Chinese 16.2%, Indians 13.8%). The fact that many more people in 11 rural villages ($N = 350$) were under-weight compared to already under-privileged shelter home residents (80% from rural area) is of major concern and this requires urgent detailed evaluation and management by Malaysian health authorities. In newly industrialized countries, poverty is common in rural regions and this, together with illiteracy may be contributing to the high rate of poor weight status seen amongst rural older people in the 2002 study by Suzana *et al.*,^{1,15} (Piammongkol *et al.*, 2004).

Although not assessed in this study, low BMIs are associated with increased mortality and poor health. Therefore, the finding that almost 15% of older residents in these shelter care facilities in Malaysia were underweight is also of major concern. In a very recent paper from the United States of America, a $BMI < 18.5 \text{ kg/m}^2$ was associated with 33, 746 excess death relative to the

normal weight category ($BMI 18.5$ to $< 25 \text{ kg/m}^2$) (Flegal *et al.*, 2005).⁷ People with low BMIs are very likely to also have sarcopenia (Iannuzzi-Sucich *et al.*, 2002).¹⁶ Reduced fat free muscle mass or sarcopenia in older people is associated with poor health outcomes (Janssen *et al.*, 2002, Janssen *et al.*, 2004a, Janssen *et al.*, 2004b).^{10,17,18} It has been suggested that a partial withdrawal of anabolic stimuli (e.g. growth hormone), especially in men, and an increase in catabolic stimuli (e.g. inflammatory cytokines), especially in women, contribute to the development of sarcopenia in older people (Payette *et al.*, 2003).¹⁹ A reduction in nutrient intake and physical activity is also thought to contribute to the development of sarcopenia in older people (Morley, 2001, Roubenoff and Hughes, 2000).^{20,21} Therefore, increasing nutrient intake, maintaining physical activity, maintenance of anabolic status (especially in men) and adequate treatment of medical illnesses (to reduce catabolism) may all be required to various degrees to improve the health status of these older shelter home residents.

Oral and dental health is very important in older people but unfortunately access to dental care is sometimes difficult. Older people who are poor, isolated and frail (as in this study) are more likely to not access dental services. In a recent study conducted in Australia, being edentulous was associated with being older, having no private dental insurance, being female, leaving school at less than 15 years of age, being poor, not owning a home, living in a rural area, and not being able to travel alone (Ringland *et al.*, 2004).²² In one large Spanish study of 3460 adults aged 65 years and older, nutritional status was assessed using the Mini Nutritional Assessment (maximum score 30) (The Spanish Geriatric Oral Health Research Group, 2001).²³ 48% of the edentulous subjects and 43% of the dentate subjects were found to be under-nourished (score < 24). Consistent with this, this study found that residents reporting no oral or dental health troubles were less likely to be underweight (and perhaps better nourished).

Regular consumption of fruit and vegetables is said to be associated with a reduced risk of developing cancer, cardiovascular disease, stroke, Alzheimer disease, cataract, and functional decline (Liu 2003).²⁴ Therefore, not surprisingly, the World Health Organization recommends adequate consumption of fruits, vegetables and milk products (Wahlqvist *et al.*, 2002).²⁵ Older people in this study who reported eating few fruits, vegetables and milk products were more likely to be underweight. As stated earlier, weight (and BMI) is often used as a surrogate marker of nutritional status and so older people who are not underweight are more likely to be better nourished (Visvanathan *et al.*, 2004).² Encouraging older people to consume fruits, vegetables and milk products should be strongly encouraged and part of any management policy.

Older people in these shelter homes often did not own their own homes and had no income or savings. Most would have been dependent on support from family or lived in poverty for lengthy periods prior to admission. In this study, older people who had no family were more likely to be under-weight. Although we have no objective evidence to support this, it is very likely that older people with family were more likely to have had better access to nutritious food prior to admission than those without

Table 1. Descriptive statistics of patients' baseline clinical characteristics and log-binomial regression univariate analysis of subjects' clinical characteristics based on the subject's weight as determined by body mass index (BMI- Underweight= <18.5kg/m²)

	BMI < 18.5 kg/m ²	BMI ≥ 18.5 kg/m ²	RR (95% CI)	P value
Number (N) (%)	140 (14.3)	839 (85.7)		
Age (years): mean (95% CI)	72.4 (71.0-73.7)	71.6 (71.1-72.1)	1.01 (0.99-1.03)	0.275
Female: N (%)	81 (57.9)	325 (38.7)	1.94 (1.42-2.64)	<0.001
No Education: N (%)	96 (68.6)	514 (61.3)	1.42 (1.00-2.03)	0.051
Rural Origin: N (%)	115 (82.1)	679 (80.9)	1.07 (0.72-1.60)	0.735
No Family: N (%)	104 (74.3)	499 (59.5)	1.80 (1.26-2.57)	0.001
Nourished as per NHC: N (%)	47 (33.6)	358 (42.7)	0.72 (0.52-0.99)	0.0454
NHC Score: mean (95% CI)	4.7 (4.1- 5.3)	3.7 (3.5- 3.9)	1.08 (1.04-1.13)	0.0003
S1- Negative response: N (%)	97 (69.3)	699 (83.3)	0.52 (0.38-0.71)	<0.001
S2- Negative response: N (%)	103 (73.6)	731 (87.1)	0.48 (0.35-0.67)	<0.001
S3- Negative response: N (%)	83 (59.3)	554 (66.0)	0.78 (0.57-1.07)	0.120
S4- Negative response: N (%)	139 (99.3)	835 (99.5)	0.71 (0.12-4.15)	0.707
S5- Negative response: N (%)	72 (51.4)	565 (67.3)	0.57 (0.42-0.77)	<0.001
S6- Negative response: N (%)	105 (75.0)	553 (65.9)	1.46 (1.02-2.09)	0.037
S7- Negative response: N (%)	117 (83.6)	736 (87.7)	0.75 (0.50-1.13)	0.168
S8- Negative response: N (%)	120 (85.7)	784 (93.4)	0.50 (0.33-0.75)	<0.001
S9- Negative response: N (%)	128 (91.4)	815 (97.1)	0.41 (0.25-0.66)	<0.001
S10- Negative response: N (%)	134 (95.7)	822 (98.0)	0.54 (0.27-1.09)	0.084
No Cognitive Impairment: n (%)	17 (12.1)	133 (15.9)	0.76 (0.47-1.23)	0.268
ECAQ score: mean (95% CI)	2.4 (1.9- 2.8)	2.8 (2.6- 3.0)	0.96 (0.91-1.02)	0.161
GDS score: mean (95% CI)	7.1 (6.6- 7.6)	7.2 (7.0- 7.4)	0.99 (0.93-1.04)	0.642
Not Depressed: N (%)	31 (24.2)	152 (21.7)	1.13 (0.78-1.63)	0.523
Barthel score: mean (95% CI)	19.2 (18.8-19.6)	19.3 (19.2-19.4)	0.98 (0.92-1.05)	0.622
Moderately-severely dependent: N (%)	6 (4.3)	23 (2.7)	1.47 (0.71-3.04)	0.304
No past history fall: N (%)	94 (67.1)	507 (60.4)	1.29 (0.93-1.78)	0.134
Medications < 3: N (%)	55 (39.3)	246 (29.3)	1.46 (1.07-1.99)	0.018
Number of illness: mean (95% CI)	0.9 (0.8- 1.0)	0.7 (0.7- 0.8)	1.19 (1.01-1.39)	0.036
No Diabetes: N (%)	133 (95.0)	769 (91.7)	1.62 (0.79-3.34)	0.1902
No Hypertension: N (%)	123 (87.9)	718 (85.6)	1.19 (0.74-1.91)	0.4780
No Asthma: N (%)	119 (85.0)	803 (95.7)	0.35 (0.24-0.51)	0.0000
No Ischaemic Heart Disease: N (%)	130 (92.9)	770 (91.8)	1.14 (0.63-2.08)	0.6667
No Osteoarthritis: N (%)	131 (93.6)	810 (96.5)	0.59 (0.33-1.06)	0.0787
No Stroke: N (%)	140 (100)	826 (98.5)	*	

NHC- 'DETERMINE Your Nutritional Health Checklist', GDS- Geriatric Depression Scale, ECAQ- Elderly Cognitive Assessment Questionnaire; S1-10- Statements in the NHC- see method; *- No residents with a low BMI had suffered a stroke and so this analysis was not possible. Statement [S] 1- I have an illness or condition that made me change the kind and/or amount of food that I eat (score 2); S2- I eat fewer than two meals per day (score 3); S3- I eat few fruits or vegetables or milk products (score 2); S4- I have 3 or more drinks of beer, liquor or wine almost every day (score 2); S5- I have tooth or mouth problems that make it hard for me to eat (score 2); S6- I don't always have enough money to buy the food I need (score 4); S7- I eat alone most of the time (score 1); S8- I take 3 or more different

family. Some with family may also be receiving extra pocket money or food products whilst in these shelter homes. Nevertheless, based on these results, it is likely that older people in the community with no family support are at high risk of developing under-nutrition and its many adverse consequences. Perhaps, the development of domiciliary support services and means tested pension systems (which currently do not exist in Malaysia) may prevent premature institutionalization and improve the health status of vulnerable older Malaysians.

This study had several limitations. Firstly, only shelter home residents were studied and the results of this study may not reflect the body weight status of the general Malaysian population. A population representative study

would be beneficial. Also, we had failed to record the time each resident had already spent at the shelter home at the time of the survey. It may be that admission to these homes improves nutritional status as food is provided by these facilities. This notion is further supported by the higher prevalence of reduced body weight noted in rural settings (40%) in contrast to these homes (18.3%) (Suzana *et al.*, 2002).¹

To conclude, this study confirms that many older people residing in publicly funded shelter care facilities in Peninsular Malaysia are underweight and have low body mass indices. Good oral and dental health in this study was associated with a better BMI. Therefore, access to dental health is important and should be ensured. The

reported consumption of fruits, vegetables and milk products was associated with a reduced risk of being underweight and so should be strongly encouraged. Older people who lack family support are at high risk of developing under-nutrition and its adverse consequences and so targeting this population group early (perhaps with community support services) may be beneficial.

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Original Article

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¹Department of Medicine, The University of Adelaide and Director, Aged and Extended Care Service, The Queen Elizabeth Hospital, South Australia, Australia

²Institute of Gerontology, University Putra Malaysia and Department of Community Health, University Putra Malaysia, Serdang, Malaysia

在马来西亚公益福利院的老人中，体重不足的发生率下降，与口腔健康、足够的营养消费和家庭支持有关

老年人越来越高的死亡率，与低的身体质量指数有关。这项研究的主要目的是鉴别与马来半岛公益福利院的老人的低身体质量指数（BMIs）(< 18.5 kg/m²) 有关的因素。我们用问卷调查的形式调查年龄大于 60 岁的 1081 个老人（59% 男性），研究基线人口统计学，营养和认知状况，身体功能和心理状况。同时测定身体质量指数。调查对象是从马来半岛的公益福利院中招募的，14.3% 的居民的体质量指数 < 18.5 kg/m²。多元分析（对年龄和性别进行调整）显示，低身体质量指数（BMIs）(< 18.5 kg/m²)，与没有家庭（相对危险度 1.98 [95% 置信区间 1.40-2.82]，P<0.001），对调查问卷“您的营养健康状况清单”中的情境 3 [我几乎不吃水果、蔬菜和奶制品]（相对危险度 0.62 [95% 置信区间 0.42-0.90]，P<0.013）、情境 5 [我有牙病或口腔疾病，使我吃东西很困难]（相对危险度 0.69 [95% 置信区间 0.50-0.96]，P<0.023）的消极反映，分别独立相关。没有家庭支持的老人受到体重不足的威胁。吃水果、蔬菜或奶制品，或口腔健康的老人则较少会体重不足。营养摄入，口腔健康和社会支持，对保证马来西亚老人的健康体重是很重要的。

关键词： 身体质量指数、口腔健康、营养、社会支持、贫穷、无家、老龄、福利院、马来西亚。