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The Third National Health and Morbidity Survey: Prevalence of Obesity, and Abdominal Obesity Among the Malaysian Elderly Population

Suzana S, MMed Sci, PhD[1], Kee CC, BSc[2], Jamaludin AR, MBBS, MPH[3], Noor Safiza MN, BSc, MSc[4], Khor GL, MSc, PhD[5], Jamaiyah H, MBBS, MPH[6], Geeta A, BSc, MSc[6], Ahmad Ali Z, BSc[4], Rahmah R, MBBS[1], Ruzita AT, MSc, PhD[1], and Ahmad Fauzi Y, MBBS, MPH[4]

Abstract

Obesity is an emerging public health threat in the elderly population in developing countries. Hence, the Third National Health and Morbidity Survey has assessed 4746 individuals aged 60 years and older recruited through a household survey to determine the prevalence of adiposity using body mass index and waist circumference. The national's prevalence of overweight and obesity in men was 29.2% (95% confidence interval [CI] = 27.2-31.3) and 7.4% (95% CI = 6.4-8.6), respectively. However, the prevalence decreased with age. The figures in women were 30.3% (95% CI = 28.5-32.1) and 13.8% (95% CI = 12.5-15.2), respectively. The prevalence of abdominal obesity was 21.4% (95%CI = 20.2-22.6), with 7.7% (95% CI = 6.7-9.0) in men and 33.4% (95% CI = 31.4-35.3) in women. Predictors of adiposity include the following: Malay and Indian ethnicity, higher education level, higher household income, from urban area, and being married. In conclusion, adiposity affects about one third of the Malaysian elderly population, especially those of the younger age group, women, and those with higher socioeconomic status.

Keywords

nutrition assessment, elderly, obesity, abdominal obesity, socioeconomic status

[1]Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia
[2]Institute for Medical Research, Kuala Lumpur, Malaysia
[3]International Islamic University Malaysia, Kuantan, Pahang, Malaysia
[4]Institute for Public Health, Ministry of Health, Kuala Lumpur, Malaysia
[5]Universiti Putra Malaysia, Serdang, Selangor, Malaysia
[6]Ministry of Health, Kuala Lumpur, Malaysia

Corresponding Author:
Suzana S, Department of Nutrition and Dietetics, Faculty of Allied Health Sciences, Universiti Kebangsaan Malaysia, Jalan Raja Muda A. Aziz, 50300 Kuala Lumpur, Malaysia
Email: suzana.shahar@gmail.com

Introduction

Overweight and obesity are considered as major public health threats not only in developed countries but also in the developing countries, including Malaysia.[1-3] Poor eating habits and sedentary lifestyle are in part responsible for the obesity epidemic and rise in noncommunicable diseases (NCDs) worldwide.[1] Despite the rapid growth in number and proportion of elderly people worldwide, epidemiological data and evidence on obesity among older adults are scarce as compared with those for the adults.[4-6] This is probably because of the lack of priority in assessing the nutritional and health status of elderly people as compared with the younger adults, who represent the majority of the population.[7] The fact that obesity has quantitatively different effects on morbidity and mortality in older individuals compared with the younger age group also contributes to the paucity in literature.[4,8]

The second National Health and Morbidity Survey (NHMS II) included weight and height measurements for 3286 individuals aged 60 years and older.[9] Approximately half (51.9%) of the older individuals had normal body mass index (BMI). The prevalence of underweight at 29.4% was higher than overweight (15.6%). Another study among rural communities in Malaysia, using a similar methodology, also found that underweight was more prevalent among the elderly age group (22.2%) as compared with their younger counterparts.[10]

However, a recent study among rural elderly Malays indicated that overweight (25% in men and 24.3% in women) was more prevalent than underweight.[11] It should be noted that all the above studies did not include measurement of abdominal obesity. Abdominal obesity is another emerging public health problem among elderly population.[12] Worldwide, there is a large variability in the prevalence of overweight and obesity among elderly people. The prevalence varies from 0% in selected Asians and Africans[13] to 64.5% (overweight) and 30.5% (obesity) in the United States.[14] Thus, the present study is the first of its kind to determine the prevalence of overweight and obesity using BMI and also indicator of abdominal obesity, that is, waist circumference (WC) among a large number of older people aged 60 years and older in Malaysia. The occurrences of obesity in relation to gender, age, and other sociodemographic profiles were also investigated. This study was part of a larger study to assess nutritional status of Malaysian population under the umbrella of the NHMS III, of which some of the findings have been reported earlier.[15,16]

Materials and Methods

Study Design and Subjects

A household interview survey was conducted in 17 200 living quarters (LQs) selected through a 2-stage random sampling design proportionate to population size throughout all states in Malaysia to determine the nutritional status of individuals aged 18 years and older. A total of 4746 individuals aged 60 years and older who resided in the selected LQs were successfully measured for body weight, standing height, and WC based on a standard procedure[17] by trained fieldworkers. Response rate, that is, the percentage of subjects who responded compared with the total eligible sample was 90%. This study has adopted the cutoff aged of 60 years and older to define an elderly individual as has been documented by the United Nations World Assembly on Ageing held in Vienna, 1982 and furthermore, the Malaysian Department of Statistics has also adopted this definition.[18]

Body weight was measured in light indoor clothing without shoes to the nearest 0.1 kg using a Tanita digital lithium weighing scale (Tanita 318, Japan), whereas height was measured without shoes to the nearest 0.1 cm using a SECA portable body meter (SECA 206, Germany).[19]

Table 1. Nutritional Status Indicator, Classification, and Cutoff Points

Indicator	Classification	Cutoff Points
BMI (kg/m^2)[14]	Underweight	<18.5
	Normal	18.5-24.9
	Overweight	25.0-29.9
	Obesity I	30.0-34.9
	Obesity II	35.0-39.9
	Extremely obese (class III)	≥40.0
Waist circumference (cm)[18]	Abdominal obesity	>102 (men) >88 (women)

In subjects in whom standing height was not possible or could not be accurately measured due to severe kyphosis, half arm span was measured as a proxy indicator of height. The half arm span predictive equation[20] was used to estimate standing height in these subjects. WC was measured at the midpoint between the inferior margin of the last rib and the crest of the ilium, to the nearest 0.1 cm using SECA measuring tape (SECA, Germany).[19] All measurements were taken twice and the average of these values was computed. Based on the weight and height measurements, BMI was computed as weight in kilograms divided by the square of the height in meters (kg/m^2). The BMI classification recommended by the World Health Organization Expert Committee on Physical Status[19] was used to determine the nutritional status of the subjects. The WC cutoff point recommended by the World Health Organization[21] was used to determine abdominal obesity (Table 1).

Data collection was conducted between April and July 2006 upon ethical approval obtained from the Ministry of Health Ethics Committee. A face-to-face interview was conducted by trained data collection team members (consisting of nonmedical and paramedical staff closely supervised by field supervisors) using a precoded questionnaires to obtain sociodemographic information. The precoded questionnaire was a bilingual (*Bahasa Malaysia* and English) questionnaire specifically designed, pretested, and piloted for the purpose of the survey. In a situation where an interview was unsuccessful because of the absence of the respondent at the selected LQ, repeated visits were conducted. A household member was classified as a nonrespondent only if three visits were unsuccessful. Substitutions were made in a systematic way.

Prior to the actual survey, a study on reliability and validity of all anthropometric measurements was carried to determine the precision of the instruments and measurements. Weight and height measurements were tested against the relative gold standard equipment, that is, the Seca beam balance. Mid-half arm span measurement was tested for reliability as reported earlier.[22] A pilot study was also conducted on a sample of enumeration blocks (EBs; not included in the NHMS III) about 2 months prior to the actual nationwide survey.

Data Entry and Analysis

A web-based data entry system that allowed multiple simultaneous accesses to the database was developed to record the information collected. A double manual data entry method was used for quality assurance. Data entry started simultaneously with data collection and was completed at the end of January 2007. The data entered were stored in the database designed using structured query language, which is a standard language for relational database management system. Analysis of the data was conducted using STATA and SPSS 15.0. All analyses took into account the complex survey design and unequal selections of NHMS III. Sample

weight was computed based on sampling unit, which was withdrawn corresponding to "frequency" that each sampling unit represents in the target population. In NHMS III, sample was weighted for strata (urban and rural), state, EB, and LQ. No adjustment was done for other variables (ie, age group, ethnicity, gender). Findings were reported as the weighted estimates of the prevalence or mean with 95% confidence interval, which is a standard way of presenting results from population survey. A binary logistic regression analysis was computed to determine the adjusted odds ratio of socioeconomic predictors of overweight, obesity, and abdominal obesity.

Results

The NHMS III had determined the BMI and WC among 4746 older individuals aged 60 years and older. Ethnically, the individuals were classified as Malay, Chinese, Indian, indigenous, and others. Their ages were categorized into 5-year intervals. Majority of subjects were in the age group of 60 to 64 years (34.7%) and 65 to 69 years (29.5%) and from Malay (52.4%) ethnicity. Most of the subjects had a household income of less than US$ 100 (RM 400; 20.7%), followed by US$ 100 (RM 400) to US$ 174 (RM 699; 18.9%), and US$ 250 (RM 1000) to US$ 500 (RM 1999; 20.1%). With respect to educational status, majority had either primary education (45%) or no schooling (39.4%). Most of them were married (68.8%).

Women were noted to have a lower education level with a higher percentage having no schooling or only primary education as compared with men. Women were identified as widowed 8 times more than were men (Table 2).

Regardless of ethnicity, the mean (95% CI) of weight, height, and BMI in men reduced with age, with the exception for indigenous individuals aged 75 years and older who had a slightly higher weight, height, and BMI as compared with their younger counterparts. Similar trend was also noted in older women, with the exception of Indian women in whom the mean BMI was comparable between the 2 age groups (Table 3).

Prevalence of Overweight and Obesity

The national prevalences of overweight and obesity among older people were 29.8% (95% CI = 28.4-31.2) and 10.8% (95% CI = 9.9-11.7), respectively. The prevalence of obesity was almost twice higher in women (13.8%; 95% CI = 12.5-15.2) than men (7.4%; 95% CI = 6.4-8.6). There was a decreasing trend of overweight and obesity with age, with those at the younger age group with higher prevalence of overweight and obesity at 35.6% and 12.8%, respectively (Figure 1). In contrast, the prevalence of underweight increased with age with almost 26.3% of those in the older age group (≥80 years) being underweight.

Prevalence of Abdominal Obesity

The national prevalence of abdominal obesity among older people in Malaysia was 21.4% (95% CI = 20.2-22.6) in men and 33.4% (95% CI = 31.4-35.3) in women. The youngest age group (60-64 years) had the highest prevalence (23.4%) whereas the oldest age group (≥80 years) showed the lowest prevalence (14.9%; Figure 2). Regardless of age group, the occurrence of abdominal obesity approximately tripled in elderly women than in men. The prevalence of abdominal obesity was the highest among Indian women (43.5%; 95% CI = 36.2-51.0). The rate among their counterparts from other ethnic groups was almost similar at around 36% to

Table 2. Demographic Characteristics of Subjects

Characteristics	n (%)		
	Men (n = 2212)	Women (n = 2534)	Total (n = 4746)
Age group (years)			
60-64	812 (36.7)	836 (33.0)	1648 (34.7)
65-69	640 (28.9)	762 (30.1)	1402 (29.5)
70-74	419 (18.9)	458 (18.1)	877 (18.5)
75-79	204(9.2)	259 (10.2)	463 (9.8)
≥80	137 (6.2)	219 (8.6)	356 (7.5)
Ethnic group			
Malay	1150 (52.0)	1337 (52.8)	2487 (52.4)
Chinese	645 (29.2)	713 (28.1)	1358 (28.6)
Indian	123 (5.6)	179 (7.1)	302 (6.4)
Indigenous	251 (11.3)	263 (10.4)	514 (10.8)
Others	43 (1.9)	42 (1.7)	85 (1.8)
Strata			
Urban	1101 (49.8)	1306 (51.5)	2407 (50.7)
Rural	1111 (50.2)	1228 (48.5)	2339 (49.3)
Household income (RM)			
<400	409 (18.5)	574 (22.7)	983 (20.7)
400-699	443 (20.0)	455 (18.0)	898 (18.9)
700-999	254 (11.4)	258 (10.2)	512 (10.8)
1000-1999	480 (21.7)	474 (18.7)	954 (20.1)
2000-2999	238 (10.8)	253 (10.0)	491 (10.3)
3000-3999	84 (3.8)	132 (5.2)	216 (4.6)
4000-4999	46 (2.1)	59 (2.3)	105 (2.2)
≥5000	114 (5.2)	133 (5.2)	247 (5.2)
Education			
None	476 (21.5)	1392 (54.9)	1868 (39.4)
Primary	1225 (55.4)	909 (35.9)	2134 (45.0)
Secondary	423 (19.1)	186 (7.3)	609 (12.8)
Tertiary	62 (2.8)	18 (0.7)	80 (1.7)
Marital status			
Not married	28 (1.3)	59 (2.3)	87 (1.8)
Married	1962 (88.7)	1304 (51.5)	3266 (68.8)
Divorcee	96 (4.3)	137 (5.4)	233 (4.9)
Widow/widower	112 (5.1)	1013 (40.0)	1125 (23.7)

38%, with the exception of individuals of indigenous ethnicity who had the lowest prevalence among women (20.5%).

Relationship Between Socioeconomic Status and Overweight, Obesity, and Abdominal Obesity

In general, overweight, obesity, and abdominal obesity were the highest among Malays and Indians, as compared with other ethnic groups (Table 4). Overweight and obesity were most prevalent among those having secondary education (48.0% and 12.2%, respectively),

Table 3. Anthropometric Characteristics of Subjects According to Gender, Ethnicity, and Age Group

Ethnicity	Age Group (Years)	Weight (kg)		Height (cm)		BMI (kg/m^2)		Waist Circumference (cm)	
		n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
Men		2172	62.4 (61.9-63.0)	2108	162.0 (161.7-162.4)	2164	23.7 (23.6-23.9)	2139	85.5 (85.0-86.1)
Malay	60-74	959	63.5 (62.7-64.3)	947	161.6 (161.2-162.1)	955	24.3 (24.0-24.6)	953	85.9 (85.1-86.8)
	≥75	170	55.6 (53.9-57.3)	151	159.9 (158.7-161.1)	170	21.8 (21.2-22.4)	170	80.6 (78.9-82.3)
Chinese	60-74	543	65.4 (64.4-66.3)	532	164.2 (163.5-164.9)	542	24.2 (23.9-24.6)	527	87.7 (86.7-88.8)
	≥75	91	58.5 (56.5-60.5)	86	163.0 (161.3-164.6)	91	22.0 (21.3-22.8)	89	90.6 (88.4-92.8)
Indian	60-74	101	65.6 (63.3-67.9))	100	163.7 (162.3-164.9)	100	24.4 (23.6-25.1)	99	90.6 (88.4-92.8)
	≥75	17	55.5 (50.6-60.4)	17	160.7 (156.9-164.5)	17	21.4 (19.8-23.0)	17	81.6 (76.4-86.9)
Indigenous	60-74	206	57.1 (55.2-59.0)	196	159.2 (158.2-160.3)	204	22.4 (21.8-23.1)	200	81.4 (79.5-83.2)
	≥75	43	51.0 (48.6-53.4)	37	153.4 (149.2-157.6)	43	22.2 (19.8-24.6)	43	76.9 (73.9-79.8)
Others	60-74	39	61.2 (56.9-65.6)	39	161.4 (159.3-163.6)	39	23.3 (22.0-24.6)	39	83.6 (79.3-87.9)
	≥75	3	49.9 (43.8-56.1)	3	158.9 (156.1-161.7)	3	19.7 (17.9-21.5)	2	70.9 (69.0-72.8)
Women		2482	55.0 (54.5-55.6)	2339	149.0 (149.4-150.0)	2468	24.6 (24.3-24.8)	2444	82.8 (82.3-83.4)
Malay	60-74	1066	56.4 (55.6-57.2)	1027	149.1 (148.6-149.5)	1064	25.4 (25.1-25.8)	1055	83.7 (82.9-84.5)
	≥75	244	46.6 (45.1-48.0)	201	145.2 (143.9-146.5)	240	21.8 (21.2-22.4)	247	78.3 (76.6-79.9)
Chinese	60-74	571	58.2 (57.4-59.1)	554	153.0 (152.3-153.6)	568	24.9 (24.6-25.3)	562	84.1 (83.2-85.0)
	≥75	123	51.5 (49.5-53.5)	109	150.1 (148.9-151.3)	122	23.0 (22.2-23.9)	113	82.2 (79.2-85.1)
Indian	60-74	141	58.9 (56.8-61.1)	140	150.9 (149.8-152.0)	140	25.8 (24.9-26.7)	139	85.6 (83.7-87.6)
	≥75	35	54.8 (50.9-58.7)	33	147.4 (145.7-149.0)	35	25.4 (23.7-27.1)	34	87.9 (82.7-93.0)
Indigenous	60-74	211	50.2 (48.5-51.8)	195	147.4 (146.3-148.5)	209	23.0 (22.3-23.7)	207	78.9 (77.0-80.7)
	≥75	50	41.5 (38.8-44.2)	39	142.8 (139.1-146.4)	49	19.4 (18.2-20.6)	47	74 (70.3-77.6)
Others	60-74	36	55.6 (50.9-60.3)	36	149.6 (147.2-151.9)	36	24.7 (22.9-26.5)	35	81.4 (76.8-86.0)
	≥75	5	52.2 (34.5-67.0)	5	148.9 (141.7-156.2)	5	23.1 (17.4-28.7)	5	82.6 (71.7-93.4)

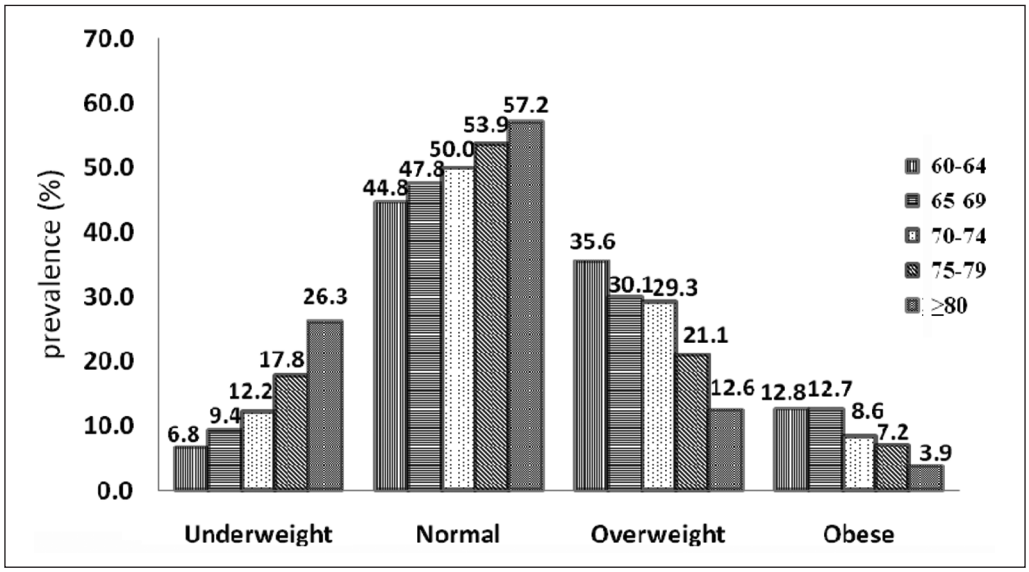

Figure 1. Prevalence of underweight, normal, overweight, and obese according to age group

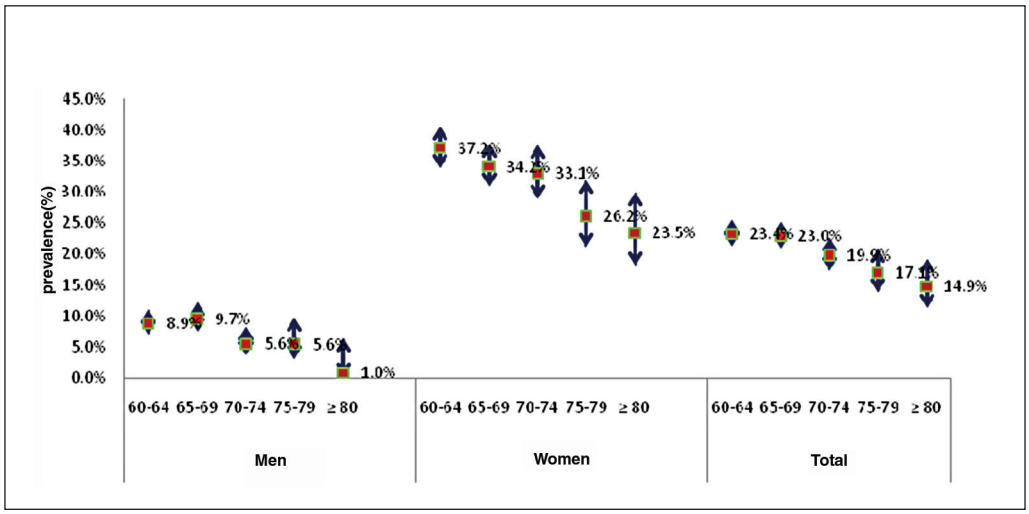

Figure 2. Prevalence of abdominal obesity among subjects according to gender

followed by those having primary education (43.5% and 11.7%, respectively; Table 4). There was a decreasing trend in the prevalence of abdominal obesity and educational attainment, with those who had received no education having the highest prevalence. Overweight and abdominal obesity were more common among subjects with household income of more than US$ 200 (RM 700; $P < .05$). Overweight was more prevalent among urban dwellers as compared with their rural counterparts (adjusted OR = 1.3; 95% CI = 1.2-1.6; $P < .05$). With respect to marital status, overweight was more prevalent

Table 4. Prevalence of Overweight, Obesity, and Abdominal Obesity by Ethnicity and Socioeconomic Status

Characteristic	Overweight (BMI ≥ 25 kg/m^2)			Obesity (BMI ≥ 30 kg/m^2)			Abdominal Obesity		
	n	% (95% CI)	aOR (95% CI)[a]	n	% (95% CI)	aOR (95% CI)[a]	n	% (95% CI)	aOR (95% CI)[a]
Gender									
Male	777	36.6 (34.5-38.8)	1	156	7.4 (6.4-8.6)	1	163	7.7 (6.7-9.0)	1
Female	1078	44.1 (42.1-46.1)	1.8 (1.6-2.1)[b]	338	13.8 (12.5-15.2)	2.7 (2.1-3.4)[b]	808	33.4 (31.4-35.5)	7.1 (5.8-8.7)[b]
Ethnicity									
Malay	1015	42.4 (40.3-44.5)	1.5 (1.2-1.9)[b]	298	12.4 (11.2-13.8)	1.4 (1.0-2.1)[c]	520	21.7 (20.0-23.4)	1.5 (1.1-2.0)[b]
Chinese	546	41.1 (38.4-43.9)	1.2 (0.9-1.5)	113	8.6 (7.2-10.2)	0.9 (0.6-1.3)	282	21.5 (19.4-23.8)	1.3 (0.9-1.8)
Indian	137	47.0 (41.4-52.6)	1.4 (1.0-1.9)	39	13.8 (10.5-18.0)	1.4 (0.9-2.4)	88	30.5 (25.6-35.9)	1.9 (1.3-3.0)[b]
Others (indigenous and others)	157	27.2 (23.2-31.5)	1	44	7.6 (5.6-10.1)	1	81	14.4 (11.6-17.7)	1
Education level									
None	602	33.9 (31.6-36.2)	1	163	9.2 (7.9-10.6)	1	413	23.4 (21.5-25.5)	1
Primary	904	43.5 (41.4-45.6)	1.5 (1.3-1.7)[b]	243	11.7 (10.4-13.1)	1.4 (1.1-1.8)[c]	425	20.8 (19.2-22.6)	1.2 (1.0-1.5)[c]
Secondary and above	327	48.0 (44.3-51.8)	1.7 (1.3-2.1)[b]	83	12.2 (10.0-14.9)	1.8 (1.2-2.5)[c]	122	18.1 (15.4-21.2)	1.2 (0.9-1.6)
Monthly household income (RM)									
<400	289	30.7 (27.7-33.9)	1	81	8.6 (7.0-10.6)	1	172	18.4 (16.0-21.0)	1
400-699	347	39.8 (36.4-43.2)	1.4 (1.2-1.7)[b]	102	11.8 (9.7-14.2)	1.4 (1.0-2.0)[c]	171	19.7 (17.2-22.4)	1.2 (0.9-1.6)
700-999	229	46.5 (42.0-51.0)	1.8 (1.4-2.2)[b]	58	11.53 (8.9-14.8)	1.3 (0.9-1.9)	122	24.5 (20.7-28.7)	1.6 (1.2-2.2)[b]
1000-1999	388	42.2 (39.0-45.4)	1.4 (1.2-1.8)[b]	109	11.9 (10.0-14.1)	1.4 (1.0-1.9)[c]	189	21.2 (18.7-23.9)	1.3 (1.0-1.6)
2000-2999	216	44.7 (40.3-49.2)	1.5 (1.2-2.0)[b]	54	10.9 (8.4-14.1)	1.2 (0.8-1.8)	115	23.8 (20.2-28.0)	1.4 (1.1-2.0)[c]
≥3000	272	49.1 (44.8-53.4)	1.8 (1.4-2.3)[b]	57	10.5 (8.2-13.3)	1.2 (0.8-1.7)	145	26.4 (22.9-30.2)	1.5 (1.2-2.0)[b]
Strata									
Urban	1049	44.9 (42.8-47.0)	1.3 (1.2-1.6)[b]	268	11.5 (10.3-12.9)	1.1 (0.9-1.4)	551	23.6 (21.9-25.4)	1.2 (1.0-1.4)
Rural	806	35.1 (33.0-37.2)	1	226	9.9 (8.7-11.2)	1	420	18.6 (17.0-20.3)	1
Marital status									
Married	1302	41.3 (39.5-43.2)	1.3 (1.1-1.5)[b]	342	10.9 (9.8-12.0)	1.3 (1.1-1.7)[c]	585	18.7 (17.4-20.2)	1.2 (1.0-1.4)
Others (unmarried/divorcee/ widow/widower)	537	38.7 (36.2-41.3)	1	147	10.6 (9.1-12.3)	1	379	27.4 (25-29.8)	1

Abbreviations: BMI, body mass index; aOR, adjusted odds ratio; 95% CI, 95% confidence interval.
[a]OR for all other variables.
[b]$P < .01$, binary logistic regression analysis (enter method).
[c]$P < .05$, binary logistic regression analysis (enter method).

among married subjects as compared with others (unmarried/ divorcee, widow/widower; adjusted OR = 1.3; 95% CI = 1.1-1.5; $P < .05$).

Discussion

Most of the subjects recruited in this study were in the younger age group, that is, aged 60 to 64 years (34.7%), followed by 65 to 69 years (29.5%), 70 to 74 years (9.8%), and 80 years and older (7.5%). These figures are consistent with the population distribution of the Malaysian elderly with 78.8% in the young-old category (60-74 years) and 19.8% in the old-old category;[18] thus, this sample represents the Malaysian elderly population.

Within a decade, the prevalence of overweight among the Malaysian elderly population has doubled from 15.6% in 1996[9] to 29.8% in 2006 as evident in the present study. Compared with the NHMS II, there was a 3-fold increased in the prevalence of obesity from 3.1% in 1996[9] to 10.8% in 2006. The series of NHMS studies are comparable as the same indicator, that is, BMI, and similar cutoff points have been used to report the magnitude of nutritional status. However, the prevalence of overweight and obesity decreased with age. This age-related decline in the prevalence of overweight could be because of better survival of the lean body structure.[23] Individuals with overweight problems had died earlier because of comorbidity related to obesity, such as cardiovascular diseases, leaving nonobese people with a higher survival rate in the older age group (cohort effect). This phenomenon is commonly observed in cross-sectional studies such as the NHMS. A more recent longitudinal study reported that in generally healthy men, there is a secular increase in body weight over the adult life span and in the few years prior to death.[8]

The prevalence of overweight among the Malaysian elderly was still lower than those reported among older people in Spain (49%),[12] Mexico (62.3%),[24] and the United States (64.5%).[8] However, it is comparable with the overweight figures observed among the Taiwanese elderly at 29.8% for men and 36.8% for women.[25] Obesity in older adults contributes to risk for cardiovascular diseases, some cancers, and impaired mobility but protects against hip fracture. However, the association between obesity and mortality declines as age increases.[26] The relation between BMI and mortality in people older than 65 years was a flat-bottomed, U-shaped curve, with mortality rising only at BMI > 31 kg/m^2 and perhaps not at any BMI in people older than 75 years. A BMI in the overweight range was associated with some modest disease risks but a slightly lower overall mortality rate,[6] thus the BMI cutoff point of 25 kg/m^2 may be overly restrictive for the elderly.[27]

Abdominal obesity as assessed using WC was also prevalent among older Malaysian affecting at least one third of the population but the problems decreased with age. As noted for the obesity trend, this is probably because of the survival of the lean body structure.[23] As reported in an earlier study,[24] the present study showed that women were 3 times more likely to develop abdominal obesity compared with men. In an elderly population, WC was a positive predictor of mortality, whereas BMI was considered a negative predictor.[27]

As reported in an earlier study in developing countries,[28] the present study also found that obesity was prevalent in individuals of higher socioeconomic status as assessed using household income and educational level. A study among 2807 individuals (aged 40-80 years) in a Malay community in Singapore also reported that obesity was associated with higher socioeconomic status in men, but the opposite trend was noted in women.[29] As observed among other age groups in Malaysia,[5,16] overweight and abdominal obesity were more prevalent among women and urban dwellers. Marital status has also been recognized as one of influencing factors of obesity in this study and in other studies as well.[30] There is a need to further investigate the association between adiposity and comorbidity among the populations studies, as another study has reported

that the prevalence of chronic illnesses, including hypertension, diabetes mellitus, and ischemic heart disease among a sample of rural elderly Malays was high at 60.1%.[31]

Given the rising prevalence of obesity, there is a need to incorporate strategies to prevent and treat obesity among the elderly. Intensive counseling strategies incorporating behavioral, dietary, and exercise components, especially among those with high cardiovascular risk have been reported to be effective in promoting weight loss and improving health outcomes among this age group.[26] However, it seems that there may be little benefit in encouraging weight loss in extreme old age (short life expectancy), especially when there are no obesity-related complications or biochemical risk factors and when strong resistance and distress arise from changes in lifelong habits of eating and exercise.[4] Instead, weight management therapy that minimizes muscle and bone losses is recommended for older persons who are obese and who have functional impairments or metabolic complications that can benefit from weight reduction.[4,32]

Despite the rapid pace of socioeconomic development, the problem of underweight still occurs in the country. Although the prevalence of underweight among the Malaysian elderly has decreased from 29.4% in 1996[9] to 11.01% at present, its occurrence increases with age (from 5.7% for those 60-64 years old to 21.9% for those ≥80 years). With the emerging concern of obesity, the underweight problem should not be overlooked as it decreases physical, social, and mental well-being[33] and increases mortality[34] among elderly people. The occurrence of dual forms of malnutrition, that is, undernutrition and overnutrition, especially within the same household emerges as a new concern in developing countries,[1] specially in countries such as Malaysia where the development has been rapid. This warrants further investigations.

Conclusion

This study concluded that approximately 30% of Malaysian elderly population were overweight or had abdominal obesity and 7% were obese. Predictors of adiposity include being a woman, married, from urban area, of Malay and Indian ethnicity, and also having a higher socioeconomic status. However, the prevalence of overweight and obesity decreased with age and underweight was a concern among the older age group, which requires further investigation. The vast variability of overweight, obesity, and underweight and also abdominal obesity within different age groups in older people warrants immediate revision of current public health policies and implementation of new interventional strategies.

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