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A Population-based Study on the Prevalence and Factors Associated with Obesity in Selangor

[1]GR Lekhraj Rampal, [2]R Sanjay, [1]MZ Azhar, [1]MS Sherina, [3]D Ambigga & [4]A Rahimah

[1]Faculty of Medicine and Health Science, Universiti Putra Malaysia 43400 UPM, Serdang, Selangor, Malaysia

[2]Faculty of Medicine, University of Malaya, 50603 Kuala Lumpur

[3]Selangor State Health Department, Selangor, Malaysia

ABSTRACT

Objective: This study was conducted to determine prevalence and factors associated with obesity in Selangor, Malaysia. **Methods:** A population-based cross-sectional study was conducted in all districts of Selangor State. All individuals, 15 years and above in the selected households, were included. A pre-tested structured questionnaire was used to collect the data. Weight was recorded using TANITA model HD-309 and height was measured using SECA Body meter Model 208. Statistical analysis was performed using Stata 8.2 taking into account the complex survey design. **Results:** The overall mean age of the 2219 respondents was 36.6(95% CI 35.7 ˘ 37.6) years. There was no significant difference in the mean age of the males and females (p=0.697). The majority of the respondents were Malays (52.9%), followed by Chinese (30.9%), Indians (15.4%) and other races (0.9%). The overall mean BMI was 24.1 kg/m^2 (95% CI=23.8- 24.4). The overall prevalence of obesity was 12.2% (95% CI 10.6%, 14.0%). There was no significant difference in the prevalence of obesity in the males compared to females (p>0.05). The prevalence of obesity increased with age up to the ages of 40-59 years and then decreased after 60 years. The highest prevalence of obesity was in the 40-59 years age groups in both sexes. The overall prevalence of obesity was significantly higher amongst the Malays (15.2%) compared to the Indians (11.6%) and Chinese (7.3%). Multivariate logistic regression analysis showed that only age and ethnicity were associated with obesity. Sex and educational level were not associated with obesity.

Keywords: Prevalence, obesity, Selangor, Malaysia, 2004

INTRODUCTION

Cardiovascular diseases are now responsible for 30% of all deaths worldwide.[1] Obesity is a well-established risk factor for cardiovascular disease in the general population.[2] Obesity has reached epidemic proportions globally, with more than 1 billion adults being overweight and 300 million of them clinically obese.[3] Obesity is showing a worrying trend, not only because it affects a large proportion of the population but also because it has started to appear earlier in life.[4] Obesity is defined strictly as an excess of adipose tissue or body

Corresponding author: GR Lekhraj Rampal
E-mail : *dr_rampal1@hotmail.com*

fat.[5] The World Health Organisation has classified adult overweight and obesity by using the body mass index (defined as the weight in kilograms divided by the square of the height in meters, kg/m2).[6] Obesity is a complex multi-factorial disease that develops from an interaction between genetic and environmental factors. The literature suggests that a series of biological factors such as timing of adiposity rebound and parental obesity, which might relate to both behavioural and biological causal mechanisms, affect carryover of fatness from childhood into adulthood.[7-11] In Malaysia the Second National Health and Morbidity Survey 1997 reported that the overall national prevalence of obesity was 4.4%.[12] The objective of this study was to determine the prevalence and factors associated with obesity in Selangor State.

MATERIALS AND METHODS

A population-based cross-sectional study was conducted in the State of Selangor in 2004. Malaysian residents aged 15 years old and above were included in the sampling frame. The Ethical Committees of the Ministry of Health Malaysia, and the Faculty of Medicine and Health Science, Universiti Putra Malaysia approved the study. Sampling was carried out by the Statistics Department of Malaysia using a stratified two-stage cluster sampling design with proportional allocation. Selangor State was divided into artificially created, contiguous geographical areas called Enumeration Blocks (EBs). An EB consisted of 80-120 living quarters with specified boundaries (either natural or artificial) that do not straddle administrative boundaries. Allocation of sample size for the study within the enumeration blocks was based on the number of Living Quarters (LQs) in the stratum. About 8 LQ were selected from a sampled EB, the actual number being determined by the size of the EB based on the latest listing exercise of the Statistics Department of Malaysia.

Data Collection

Trained interviewers using a structured pre-tested questionnaire interviewed the study participants. The interviewer obtained verbal consent from the subjects before administrating the interview. Information given was immediately transcribed onto the questionnaire. Age was computed from the information on date of birth and date of interview.

Anthropometrics Measurements

Weights were measured to the nearest 0.1-kilogram using a digital scale (TANITA model HD 309). It was checked frequently by the use of a known weight. The respondent was requested to stand bare feet with light clothing on. Height was measured by using a body meter (SECA Model 208), which has a 0.05 centimeter precision . The body meter was suspended two meters high from the floor against a straight wall, parallel to either the doorframe or pillar. The respondent was requested to stand bare feet below the centre of the measuring tongue of the body meter, leaning against the wall with the back straight, heels resting together against the wall or pillar, and the hands loosely on the side. While the respondent looked straight ahead, the measuring tongue was lowered towards the head until it gently touched the top of the head. Height measurement as appearing in the read-off area was then recorded.

Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters. Classification of nutritional status including obesity based on BMI is in accordance with the recommendation of the World Health Organisation[13] as follows:

BMI = less than 18.5 kg/m^2	˘	Underweight
BMI = 18.5 - <25 kg/m^2	˘	Normal
BMI = 25 - < 30 kg/m^2	˘	Overweight
BMI = 30 kg/m^2 or more	˘	Obese

Statistical Methods

The study data was initially entered into SPSS version 12.0 [14], and then analysed using Stata 8.2 software.[15] The analysis took into account the complex survey design employed. The design weight was calculated based on the sampling design. Post stratification adjustment of the weights was performed and took into account non-responses, gender and race between the sample and the Selangor population. The weights were further adjusted based on the age distribution differences between the sample and the total Malaysian population. Only weighted estimates are presented. Continuous variables are presented as means with their standard errors (SE). The lincom command was used to estimate differences of survey means, which is similar to the two-tailed *t*-test. Categorical variables are presented as percentages with their standard error percent. To investigate relationships between categorical variables, the svytab command was used and the *F*-statistic interpreted from the Rao-Scott correction of chi-squared tests. [16] The svylogit command (pseudo likelihood estimates) was used to perform logistic regression analysis to measure the association between obesity and its determinants, and reports the odds ratio (OR) with its 95% confidence interval (95% CI). Significantly associated variables from univariate analysis of obesity were included in the logistic regression. A two sided *p*-value of < 0.05 was considered as statistically significant.

RESULTS

There were a total of 2528 respondents aged 15 years old and above in the selected households. Of these 2528 respondents, a total of 2219 aged 15 years and above participated in the study, giving a response rate of 87.8%. Table 1 shows the characteristics of respondents by sex, age and ethnicity. The majority (59.4%) of the respondents were females. The overall mean age of the respondents was 36.6 (95% CI 35.7 ˘ 37.6) years with a median of 35 years. The difference between the mean ages of the male respondents (36.5 years) and the female respondents (36.8 years) was not statistically significant (p=0.697). The majority of the respondents were Malays (52.9%), followed by Chinese (30.9%), Indians (15.4%) and other races (0.9%). The overall mean body mass index for the respondents was 24.1 kg/m^2 (95% CI=23.8- 24.4) with a range of 14.0 kg/m^2 ˘ 44.4 kg/m^2. The median was 23.4 kg/m^2.

Table 1. Characteristic of respondents by age, sex and ethnicity

Characteristics of respondents	Frequency (N=2219)	Unweighted percentage	Weighted percentage
Sex			
Female	1318	59.4	49.2
Male	901	40.6	50.8
Total	2219	100.0	100.0
Age Group			
15 ˘ 19	290	13.1	15.2
20 ˘ 29	489	22.0	24.9
30 ˘ 39	404	18.2	20.6
40 ˘ 49	411	18.5	17.5
50 ˘ 59	308	13.9	11.6
60 and above	317	14.3	10.1
Ethnicity			
Malay	1253	56.5	52.9
Chinese	427	19.2	30.9
Indian	491	22.1	15.4
Others	48	2.2	0.9

Table 2. Prevalence of obesity by age and sex

Age (Years)	Prevalence % (SE%)		
	Men	Women	Both sexes
Age standardised, ≥ 15	10.9 (1.2)	13.6 (1.1)	12.2 (0.8)
Age standardised, ≥ 20	11.2 (1.3)	14.4 (1.2)	12.8 (1.0)
Age standardised, ≥ 30	12.1 (1.6)	15.4 (1.5)	13.7 (1.2)
Age standardised, ≥ 40	12.4 (1.8)	18.0 (1.9)	15.2 (1.4)
15 ˘ 19	9.0 (2.7)	8.6 (2.0)	8.8 (1.7)
20 ˘ 29	9.1 (2.0)	12.1 (2.0)	10.6 (1.3)
30 ˘ 39	11.5 (2.5)	10.4 (2.1)	11.0 (1.6)
40 ˘ 49	15.1 (3.2)	18.3 (2.8)	16.7 (2.3)
50 ˘ 59	12.1 (3.0)	22.2 (3.5)	16.9 (2.2)
≥ 60	7.8 (2.3)	13.1 (2.5)	10.5 (1.6)

Table 2 shows the prevalence of obesity by age and sex. The overall prevalence of obesity was 12.2% (95% CI 10.6%, 14.0%). The prevalence of obesity was higher among the females (13.6% with 95% CI 11.5% - 15.9%) compared to 10.9% (95% CI 8.8% - 13.4%) among the males, but the difference was not statistically significant. The prevalence of obesity increased with age up to the ages of 40-59 years and then decreased after 60 years. The highest prevalence of obesity was in the 40-59 years age groups in both sexes.

Table 3. Prevalence of obesity by ethnicity and sex

Ethnicity	Prevalence % (SE %)		
	Both	Men	Women
Malay	15.2 (1.2)	13.6 (1.6)	16.9 (1.5)
Chinese	7.3 (1.3)	7.7 (2.1)	6.9 (1.6)
Indian	11.6 (1.4)	7.6 (1.8)	15.8 (2.2)
Others	11.2 (5.1)	14.1 (8.2)	8.7 (6.1)

Table 3 shows that the overall prevalence of obesity was significantly higher amongst the Malay (15.2% with 95% CI 13.0% - 17.7%) compared to the Indians (11.6% with 95% CI 9.1% - 14.7) and Chinese (7.3% with 95% CI 5.1 - 10.3). There was a significant association between prevalence of obesity and ethnicity ($p< 0.001$). Amongst the males, the prevalence of obesity was higher amongst the Malays (13.6%) compared to Chinese (7.7%) and Indians (7.6%) (Table 3). For the females, the prevalence was also high for the Malays (16.9%) compared to the Indians (15.8%) and Chinese (6.9%).

Table 4. Prevalence of obesity by education level and sex

Education level	Prevalence % (SE %)		
	Both	Men	Women
No formal education	15.1 (3.1)	2.7 (2.8)	18.4 (3.4)
Primary	15.9 (2.0)	10.4 (2.6)	21.0 (2.8)
Secondary	11.7 (1.0)	11.4 (1.5)	12.0 (1.3)
College/University	9.7 (1.5)	10.7 (2.4)	8.2 (1.9)

Table 4 shows that the prevalence of obesity was highest amongst respondents with primary education (15.9% with 95% CI 12.4% - 20.1%) and those with no formal education (15.1% with 95% CI 10.0%- 22.2%). Multivariate logistic regression analysis was carried out to assess the relation between obesity while controlling for confounders.

Table 5 shows the adjusted analysis results. Only age and ethnicity were associated with obesity. Sex, educational level and smoking status were not associated with obesity. As age increased, the risk of obesity also increased up to age 59 years in males and 49 years in females. Those respondents who were 40 to 50 years old had 2.16 times higher risk and those aged 50 to 60 had 2.05 times higher risk of being obese compared with those aged below 20 years. Although those with secondary education, primary education and those with no formal education had a higher risk compared to those with tertiary/university education, the results were not significant and could have been due to chance or could be due to other factors such as dietary factors and physical activity level.

Table 5. Relationship between obesity and its determinants

Determinants	Crude OR (95%CI)	Adjusted OR (95% CI)*
Sex		
Male	1.00	1.00
Female	1.29 (0.97, 1.71)	1.26 (0.95, 1.68)
Age group		
15 ˘ 19	1.00	1.00
20 ˘ 29	1.22 (0.74, 2.02)	1.23 (0.74, 2.05)
30 ˘ 39	1.27 (0.76, 2.12)	1.40 (0.84, 2.35)
40 ˘ 49	2.07 (1.23, 3.49)	2.16 (1.28, 3.65)
50 ˘ 59	2.11 (1.24, 3.58)	2.05 (1.15, 3.64)
e*f* 60	1.21 (0.73, 2.01)	1.19 (0.66, 2.15)
Ethnicity		
Chinese	1.00	1.00
Malay	2.28 (1.51, 3.44)	2.42 (1.59, 3.67)
Indian	1.67 (1.05, 2.67)	1.69 (1.04, 2.75)
Others	1.60 (0.53, 4.84)	1.57 (0.52, 4.78)
Education level		
College/University	1.00	1.00
Secondary	1.23 (0.83, 1.82)	1.10 (0.74, 1.62)
Primary	1.76 (1.13, 2.73)	1.38 (0.842.28)
No formal education	1.65 (0.94, 2.91)	1.41 (0.73, 2.71)

* Estimates are adjusted for the corresponding covariates shown in the table.

DISCUSSION

Urbanisation exerts a strong social impact and brings about a shift in eating habits. Urban dwellers tend to eat out and take-away food owing to increasing affluence, changing consumer food preferences, appealing influence of advertisements and for reasons of time-saving and convenience, especially for households with dual working spouses.[17] This study indicates that the prevalence of obesity in Selangor state was 12.2% which is higher than the national prevalence of 4.4% reported in Malaysia in 1996.[12] We are not able to compare with the prevalence of obesity in 1996 as the figures were not reported in the NHMS (1997) report.[12] The state of Selangor has experienced rapid demographic and economic development in recent decades leading to increased urbanisation, affluence, and changes in lifestyles and nutritional status of the population. There is a need for concern on the high prevalence of obesity in the state. Cardiovascular diseases, premature death, high blood pressure, osteoarthritis and diabetes have been reported to be associated with overweight and obesity.[2,18] Popkin[19] reported that the increased consumption of meals away from home and Western fast foods is closely associated with increased consumption of fats and oils, meat, sugar as well as a rise in alcohol intake and smoking. Frequent eating out may lead to an unhealthy lifestyle, increased prevalence of overweight problems in both adults and children, especially when coupled with a low level of physical activity.[17]

In this study, the prevalence of obesity was higher among the females (13.6%) compared to the males (10.9%) but the multivariate analysis showed that sex was not significantly associated with obesity. The Second National Health and Morbidity Survey 1997 reported higher prevalence among the females.[12] In this study, the highest prevalence of obesity was in the 40-59 years age groups in both sexes, decreasing after 60 years. The NHMS also reported that the prevalence of obesity increases with age up to 50 years and subsequently decreases after the age of 60 years.[12] This may be due to a more sedentary lifestyle accompanied by poorer nutritional habits. The risk of cardiovascular diseases and other chronic disease are independently increased, as one gets older; thus any lifestyle intervention programmes planned for the population should include this group as one of their main target groups.[20] In this study, the Malays had higher rates compared with the Indians and Chinese in both sexes. The Second National Health and Morbidity Survey reported in 1997 that prevalence of obesity in Malays and Indians was found to be significantly higher than in the Chinese.[12] Ismail *et al* [21] in 2002 reported that all ethnic groups in Malaysia seem to be involved in nutritional transition, with rapidly increasing rates not only to overweight but particularly abdominal obesity with its recognised serious health outcomes. The National Health Survey in Singapore 1992 showed a similar finding where Indians had the highest proportion of obese persons (10%), followed by Malays (6%) and Chinese (3%).[22] This may reflect different nutritional and physical behaviours among the Chinese.

Mokdad *et al.* [23] in the United States reported that people with less than a high school education had a higher prevalence of obesity. In this study, those with no formal education or primary education also had the highest prevalence. However, multivariate logistic regression analysis showed that there was no significant association between prevalence of obesity and education level ($p>0.05$). In conclusion, this study indicates that the prevalence of obesity in Selangor State is high (12.2%) and obesity is associated with age and ethnicity.

There is need for a population-wide approach to primary prevention of obesity with more intensive inter-sectoral and intra-sectoral collaboration as well as community partnership and ownership.

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