

Original Article

A national study on the prevalence of obesity among 16,127 Malaysians

Lekhraj Rampal MBBS, MPH, DrPH¹, Sanjay Rampal MBBS, MPH², Geok Lin Khor PhD¹, Azhar Md Zain MD, M Psych Med¹, Shafie Bin Ooyub MBBS, MPH³, Ramlee Bin Rahmat MBBS, MPH³, Sirajoon Noor Ghani MBBS, MPH² and Jayanthi Krishnan MBBS, MPH⁴

¹Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Malaysia

²Faculty of Medicine, University of Malaya, Malaysia

³Ministry of Health Malaysia

⁴Department of Health, City Hall Kuala Lumpur, Malaysia

A population-based cross-sectional study was conducted in all states of Malaysia with the aim to determine the prevalence of obesity among Malaysians aged fifteen years and above and factors associated. A stratified two-stage cluster sampling design with proportional allocation was used. Trained interviewers using a standardized protocol obtained the weight and height measurements and other relevant information. Subjects with a body mass index ≥ 30 kg/m² were labelled as obese. The results show that the overall national prevalence of obesity among Malaysians aged 15 years old and above was 11.7% (95% CI = 11.1 - 12.4%). The prevalence of obesity was significantly higher in females (13.8%) as compared to 9.6% in males ($p < 0.0001$). Prevalence of obesity was highest amongst the Malays (13.6%) and Indians (13.5%) followed by the indigenous group of "Sarawak Bumiputra" (10.8%) and the Chinese (8.5%). The indigenous group of "Sabah Bumiputra" had the lowest prevalence of 7.3%. These differences are statistically significant ($p < 0.0001$). Logistic regression analysis results show that there was a significant association between obesity and age, gender, ethnicity urban/rural status and smoking status. The prevalence of obesity amongst those aged ≥ 18 years old has markedly increased by 280% since the last National Health and Morbidity Survey in 1996. Conclusion: The overall prevalence of obesity in Malaysia is very high as compared to 1996. There is an urgent need for a comprehensive integrated population-based intervention program to ameliorate the growing problem of obesity in Malaysians.

Key Words: prevalence, obesity, ethnicity, Malaysia

INTRODUCTION

Obesity is a well-established risk factor for cardiovascular disease in the general population.^{1,2,3} Cardiovascular disease is a leading cause of mortality and morbidity in developed and developing countries including Malaysia.⁴ Obesity is recognized as a major determinant of many other non-communicable diseases such as cancers, gallbladder diseases, respiratory problems and musculoskeletal disorders. It also induces type 2 diabetes mellitus. Moderate weight loss (10% to 15% of body weight) has been shown to decrease health risks and medical problems in 90% of obese patients. This is due to improvements of their heart function, blood pressure, glucose tolerance and lipid profiles, as well as decreased requirements for medication, decreased incidence and duration of hospitalization, and decreased postoperative complications.⁵

In Malaysia, cardiovascular mortality increased 15 folds from 1950 to 1989 and presently accounts for about 30% of total deaths among adults.⁶ In light of this development; cardiovascular risk factors including obesity have increasingly gained the attention of policy makers and researchers. Second National Health and Morbidity Survey in 1996 recorded a prevalence of 4.4% obese and 16.6% overweight adults aged ≥ 18 years.⁷

In the 1990s, other smaller studies have also reported on the prevalence of overweight and obesity in men and women from both urban and rural areas.^{8,9} Malaysia is a middle-income country with a multi-ethnic population. Majority are Malays ($\approx 60\%$) followed by Chinese ($\approx 28\%$) and Indian ($\approx 8\%$). The aim of this study was to determine the prevalence of obesity among Malaysians aged 15 years and above and to determine the association between obesity and age, gender, ethnicity, education level, smoking status, urban / rural status and self esteem.

MATERIALS AND METHODS

Study design

A population-based cross-sectional study was conducted in all states of Malaysia in 2004. Malaysian residents aged 15 years old and above were included in the sampling frame.

Corresponding Author: Prof. Dr. Lekhraj Rampal, Department of Community Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 Serdang, Malaysia
Tel: 603-89472411; Fax: 603-89450151
Email: dr_rampal1@hotmail.com

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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. Each State and the Federal Territory of Kuala Lumpur constituted a primary stratum. The whole country was divided into artificially created, contiguous geographical areas called Enumeration Blocks (EBs). An EB consisted of 80-120 living quarters and has 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 conducting the interview. Information given was immediately transcribed to the questionnaire. Age was computed from the information on date of birth and date of interview.

Anthropometric measurements

Weights were measured to the nearest 0.1-kilogram using a digital scale (TANITA model HD 309). Height was measured by using a Body meter (SECA Model 208), which has a precision of up to 0.05 centimetres. The Body meter was suspended two meters high from the floor against a straight wall, parallel to either the door-frame or pillar. The respondent was requested to stand bare feet below the center 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 looks straight ahead, the measuring tongue was lowered towards the head until it gently touches the top of the head. Height measurement as appeared 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. Respondents were classified as obese if their BMI was 30 kg/m² or higher, in accordance with World Health Organization recommendation.⁴

Statistical analysis

This study was designed to provide national estimates of the prevalence of obesity amongst those aged 15 years old and above in Malaysia. All data was analysed using Stata 8.2 software and took into account the complex survey design employed.¹⁰ The dependent variable was obesity and the independent variables were ethnicity, age sex, smoking status and education level. Further analysis was also carried out to determine the prevalence of obesity for the different age groups for comparison purposes. The sampling weights were calculated based on the sampling design. Post stratification adjustment of the weights was

performed taking into account gender, ethnicity and age distribution differences between the sample and the total Malaysian population. Continuous variables were summarised as means and its 95% confidence interval (CI). The lincom command used to estimate differences of survey means is similar to two-tailed t test. Categorical variables are presented as percentages and its 95% confidence intervals. The F statistic from the Rao-Scott correction of chi-squared tests is used to test for statistical differences between proportions.¹¹ Logistic regression analysis was used to determine the association between obesity and age, sex, ethnicity, educational level, self esteem and smoking status. From the model building process, self esteem and educational level was found to be not significant and removed from the final model. Hosmer and Lemeshow chunk test revealed that the first order interactions was not statistically significant. A two-sided *p*-value of < 0.05 was considered as statistically significant.

RESULTS

Table 1 shows the characteristics of the respondents by age, sex and ethnicity. Out of the 18,805 respondents aged 15 years and above, weight and height measurements were recorded for 16,127 respondents giving a response rate of 85.8%. Majority of the respondents were Malays (55.1%) followed by Chinese (20.7%), Indians (10.8%) and other ethnic groups (13.4%). Majority (57.2%) of the respondents were females. The overall mean and median ages were 36.7 (95% CI= 36.3, 37.1) and ranged from 15 to 93 years. The difference between the mean age of males (36.6 years, 95% CI=36.1, 37.0) as compared to females (36.8 years, 95% CI=36.4, 37.3) was statistically not significant (*t* = 0.307, *p*=0.36). Information on age, sex and ethnicity, education level, self-esteem, current smoking status, was recorded for all (100%) the 16,127 respondents.

Table 1. Characteristics of respondents by age, gender and ethnicity

	Frequency (N=16,127)	Percentage
Gender		
Female	9,293	57.6
Male	6,834	42.4
Age		
15 – 19	2,152	13.3
20 – 29	2,947	18.3
30 – 39	3,133	19.4
40 – 49	3,129	19.4
50 – 59	2,396	14.9
60 and above	2,370	14.7
Ethnicity		
Malay	8,886	55.1
Chinese	3,339	20.7
Indian	1,748	10.8
Others	204	1.26
Bumiputra Sarawak	684	4.24
Bumiputra Sabah	1,266	7.85

Table 2. Prevalence of obesity by age, sex and ethnicity

Characteristic	Prevalence % (95%CI)		
	Male	Female	Both sexes
Age (Years)			
15 – 19	7.2 (5.6, 9.2)	5.8 (4.6, 7.3)	6.5 (5.5, 7.8)
20 – 29	8.8 (7.2, 10.7)	10.0 (8.5, 11.7)	9.4 (8.3, 10.6)
30 – 39	9.8 (8.2, 11.7)	13.8 (12.3, 15.6)	11.8 (10.7, 13.1)
40 – 49	12.1 (10.3, 14.2)	20.7 (18.7, 22.8)	16.4 (14.9, 17.9)
50 – 59	11.3 (9.2, 13.6)	22.7 (20.4, 25.2)	16.8 (15.2, 18.6)
≥ 60	8.8 (6.9, 11.3)	13.2 (11.4, 15.2)	11.1 (9.7, 12.6)
Ethnicity			
Malay	10.5 (9.5, 11.7)	16.6 (15.5, 17.8)	13.6 (12.8, 14.5)
Chinese	8.4 (6.9, 10.3)	8.5 (7.3, 9.8)	8.5 (7.4, 9.6)
Indian	9.8 (7.7, 12.4)	17.2 (14.9, 19.8)	13.5 (11.9, 15.3)
Bumiputra Sarawak	9.3 (6.1, 13.9)	12.3 (9.1, 16.5)	10.8 (8.3, 14.0)
Bumiputra Sabah	6.1 (4.2, 8.8)	8.5 (6.4, 11.3)	7.3 (5.7, 9.3)
Overall age standardized age ≥ 15	9.6 (8.8, 10.5)	13.8 (13.0, 14.7)	11.7 (11.1, 12.4)
Overall age standardized age ≥ 20 years	10.1 (9.2, 11.0)	15.2 (14.3, 16.2)	12.6 (12.0, 13.4)

Prevalence of Obesity by age, gender and ethnicity

Table 2 shows the prevalence of obesity by age, gender and ethnicity. The overall national prevalence of obesity among Malaysians aged 15 years old and above was 11.7% (95% CI= 11.1, 12.4). The prevalence of obesity increased with age. For males, the prevalence of obesity increased with age and peak at age 40-49 years and for the females, the prevalence of obesity also increase with age but peak at 50-59 years. The bivariate analysis results showed that prevalence of obesity was significantly associated with age ($p < 0.001$). Further analysis was also carried out to determine the prevalence of obesity for those age eighteen years and above so it can be used for comparison with the Second National Morbidity Survey in 1996¹¹. When compared with the obesity prevalence of 4.4% in respondents aged eighteen years and above reported in the Second National Health and Morbidity Survey in 1996, this study found an overall prevalence of obesity of 12.3% (95% CI=11.6, 13.0). For those aged 18 years and above, the overall prevalence of obesity for female was 14.7% (95% CI=13.8, 15.6) as compared to the males (9.8%, 95% CI=9.0, 10.8).

The results also show that the prevalence of obesity was significantly higher in females 13.8% (95% CI= 13.0, 14.7) as compared to 9.6% (95% CI= 8.8, 10.5) in males ($p < 0.0001$). The number of Malaysian with obesity was than computed. The results show that there were approximately 1.85 million obese people (95% CI 1.75 to 1.96 million) in Malaysia (0.76 million obese men and 1.09 million obese women).

Prevalence of Obesity by ethnicity

The prevalence of obesity was highest amongst the Malays (13.6%, 95% CI =12.8, 14.5) and Indians (13.5%, 95%CI = 11.9, 15.3). The indigenous group of Bumiputra Sabah had the lowest prevalence of obesity (7.3%, 95% CI =5.7, 9.3) followed by the Chinese (8.5%, 95% CI= 7.4, 9.6). The difference in prevalence of obesity between Malays and Chinese and between Indians and Chinese were statistically significant ($p < 0.0001$) for both sexes combined. The difference in prevalence of obesity

among the females was statistically significant ($p < 0.0001$) between Malay and Chinese, and between Indians and Chinese. However, among male respondents, the difference in the prevalence was statistically significant ($p < 0.05$) only between Malays and Chinese. Uni-variate analysis showed that there was a significant association between prevalence of obesity and ethnicity ($p < 0.0001$).

Prevalence of Obesity by Educational Level, Urban Status, Self Esteem and Smoking status

Table 3 shows the prevalence of obesity by education level, urban status, self-esteem and smoking status. The results show that the overall prevalence of obesity was highest for those respondents who had primary education (14.6%) or no formal education (13.0 %) followed by those with secondary education (11.2%). Those with college or university education had the lowest prevalence of obesity (8.8%). For the males, the prevalence of obesity was highest for those with secondary education (10.1%) followed by those with college or university education (9.3%) and primary education (9.2%). Those with no formal education had the lowest prevalence of obesity (6.1%). However, for the females the pattern is different. For the females, the prevalence of obesity was highest for those with primary education (19.8%) followed by those with no formal education (15.4%) and secondary education (12.4%). Those with college or university education had the lowest prevalence of obesity (8.2%). Univariate analysis showed that there was significant association between obesity and level of education attained ($p < 0.001$).

Prevalence of Obesity by rural/urban status

Overall the prevalence of obesity was slightly higher in the urban areas (12%) as compared to the rural areas (11.3%) however, this difference was not statistically significant ($p > 0.05$).

Prevalence of Obesity by self-esteem

The results showed that there was no significant association between obesity and self esteem ($p > 0.05$).

Table 3. Prevalence of obesity by education level, urban status, self esteem and smoking status

	Prevalence % (95%CI)		
	Men	Women	Both
Education Level			
No formal education	6.1 (4.0, 9.3)	15.4 (13.3, 17.6)	13.0 (11.4, 14.9)
Primary	9.2 (7.7, 10.9)	19.8 (18.1, 21.6)	14.6 (13.4, 15.9)
Secondary	10.1 (9.1, 11.2)	12.4 (11.4, 13.4)	11.2 (10.4, 12.0)
College/University	9.3 (7.3, 11.7)	8.2 (6.5, 10.3)	8.8 (7.5, 10.4)
Urban Status			
Rural	9.1 (7.9, 10.4)	13.5 (12.3, 14.8)	11.3 (10.4, 12.3)
Urban	10.0 (8.9, 11.1)	14.0 (12.9, 15.1)	12.0 (11.2, 12.8)
Self esteem			
Low	8.6 (7.3, 10.2)	13.4 (11.9, 14.9)	10.9 (9.9, 12.0)
Moderate	9.0 (7.9, 10.2)	14.4 (13.3, 15.6)	11.7 (10.9, 12.6)
High	11.6 (10.0, 13.5)	13.3 (12.0, 14.8)	12.5 (11.4, 13.7)
Smoking status			
Non Smoker	10.8 (0.6)	13.6 (0.4)	12.8 (12.1, 13.5)
Current Smoker	8.2 (0.6)	9.6 (1.9)	8.3 (7.3, 9.5)

Table 4. Association between obesity and age, gender, ethnicity, rural/urban status and current smoking status

	Crude OR (95%CI)	Adjusted OR (95% CI) *
Ethnicity		
Chinese	1.00	1.00
Malay	1.71 (1.46, 2.00)	1.99 (1.67, 2.36)
Indian	1.70 (1.39, 2.07)	1.81 (1.47, 2.22)
Bumiputra Sarawak	1.31 (0.94, 1.82)	1.48 (1.05, 2.08)
Bumiputra Sabah	0.85 (0.63, 1.15)	1.02 (0.75, 1.39)
Gender		
Male	1.00	1.00
Female	1.50 (1.35, 1.68)	1.27 (1.12, 1.44)
Age groups		
15 – 19	1.00	1.00
20 – 29	1.48 (1.17, 1.88)	1.60 (1.27, 2.02)
30 – 39	1.92 (1.54, 2.39)	2.15 (1.73, 2.68)
40 – 49	2.80 (2.26, 3.47)	3.13 (2.52, 3.88)
50 – 59	2.90 (2.32, 3.62)	3.24 (2.59, 4.05)
≥ 60	1.79 (1.42, 2.26)	2.04 (1.62, 2.58)
Urban Status		
Rural	1.00	1.00
Urban	1.07 (0.94, 1.21)	1.16 (1.02, 1.32)
Current smoking status		
Yes	1.00	1.00
No	1.62 (1.39, 1.89)	1.52 (1.27, 1.81)

Prevalence of Obesity by smoking status

The prevalence of obesity was significantly higher amongst the non-smoker as compared to the current smoker ($p < 0.01$).

Association between Obesity and Age, Sex, Ethnicity, Educational Level, Current Smoking Status and Rural/Urban Areas

Table 4 shows the results of the logistic regression analysis. The results show that there was a significant association between obesity and age, gender, ethnicity, urban/rural status and smoking status. The results also show

that as compared to the Chinese, Malays had approximately two times higher risk of being obese (adjusted OR = 1.99, 95% CI = 1.67, 2.36). The Indians had 1.81 times higher risk of being obese as compared to Chinese (adjusted OR = 1.81, 95% CI = 1.47, 2.22). Although the results show that the Chinese had a slightly lower risk as compared to the indigenous people from the state of Sabah “Sabah Bumiputra”, the difference was not significant and could have been due to chance (adjusted OR = 1.02, 95% CI = 0.75, 1.39). Further analysis was also carried out to determine difference in the prevalence of obesity between the Malays and the indigenous people

“Sabah Bumiputra” from the state of Sabah. The indigenous people “Sabah Bumiputra” had a significant lower risk as compared to Malays (adjusted OR = 0.51, 95%CI=0.39, 0.68).

The results also show that females have 1.27 times higher risk as compared to the males (adjusted OR 1.27, 95% CI=1.12, 1.44). Those in the urban areas had a slightly higher risk as compared to those in the rural areas (adjusted OR =1.16 (1.02, 1.32). Current smokers tend to have a lower risk 1.52 (1.27, 1.81) as compared to non-smokers.

DISCUSSION

Malaysia has experienced rapid economic development in recent decades leading to increased urbanization, affluence, and changes in lifestyles and nutritional status of the population. Khor¹² reported that urbanization exerts a strong social impact on the diet of people. Urban dwellers tend to eat away from home. Households with dual working spouses tend to eat out in restaurants and fast food outlets / stalls for reason of convenience and timesaving.

When compared with the obesity prevalence of 4.4% in adults aged 18 years and above reported in the Second National Health and Morbidity Survey in 1996, this study found an overall prevalence of obesity of 12.3%.⁷ This indicates that obesity prevalence in 2004 was 280% higher than that in 1996. At this level, the obesity prevalence in Malaysia is higher than that in France (7%) and United Kingdom (9%) but lower than that in the United States (20.9%).^{12,13} The method of measuring height and weight in this survey is comparable to that used in the previous survey in 1996. This makes it unlikely that the difference in prevalence is due to different methods of measurement.

The rising problem of obesity especially in the females is a cause of concern. The present results showed that independent of age, the odds of women were 1.3 times more likely to be obese compared with men. Obesity prevalence rates were also higher in adults between the ages of 40–59 years old. This may be due to increased sedentary lifestyle with age accompanied by a change in body composition leading to higher lean body mass proportion. Independently the risk of cardiovascular diseases and other chronic disease increases as one gets older; thus, any lifestyle intervention programs planned for the population should include this group as one of the main target groups. Lessons may be learnt from the experiences of other countries where a comprehensive cardiovascular disease prevention program targeted at the community level have been developed.¹⁴

The significant association between obesity and ethnicity is in keeping with the finding of the Second National Health and Morbidity Survey, which showed there were more obese Malays and Indians as compared to Chinese. The National Health Survey in Singapore 1992 reported a similar finding where Indians had the highest proportion of obese persons (10%), followed by Malays (6%) and Chinese (3%).¹⁵ These results are likely to reflect different dietary patterns and physical activity behaviour among these ethnic groups.

CONCLUSION

As the problem of obesity has increased substantially in the past decade, there is an urgent need for a national strategy for health promotion towards the reduction of overweight and obesity among Malaysian adults. We recommend the adoption of a population-wide approach for primary prevention of obesity. Towards this end, innovative approaches should be used to forge effective partnerships between public sector, private agencies and the community.

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Original Article

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Lekhranj Rampal MBBS, MPH, DrPH¹, Sanjay Rampal MBBS, MPH², Geok Lin Khor PhD¹, Azhar Md Zain MD, M Psych Med¹, Shafie Bin Ooyub MBBS, MPH³, Ramlee Bin Rahmat MBBS, MPH³, Sirajoon Noor Ghani MBBS, MPH² and Jayanthi Krishnan MBBS, MPH⁴

¹ Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Malaysia

² Faculty of Medicine, University of Malaya, Malaysia

³ Ministry of Health Malaysia

⁴ Department of Health, City Hall Kuala Lumpur, Malaysia

一個16,127名馬來西亞人的全國性肥胖盛行率研究

一個基於人口的橫斷性研究在馬來西亞各州進行，目的為測定 15 歲以上馬來西亞人的肥胖盛行率及相關因子。採用等比例分配兩段分層集束抽樣。訓練過的訪員以標準程序取得體重、身高及其他相關資訊。身體質量指數 ≥ 30 kg/m² 定義為肥胖。結果顯示 15 歲以上的馬來西亞人之全國肥胖盛行率為 11.7%(95% CI =11.1-12.4%)。女性(13.8%)的肥胖盛行率顯著高於男性(9.6%)($p<0.0001$)。肥胖盛行率由高為低依序為馬來人 (13.6%)、印度人 (13.5%)、原住民中的 Sarawak Bumiputra (10.8%)及華人 (8.5%)。盛行率最低的則為原住民中的 Sabah Bumiputra(7.3%)。這些差異皆達統計顯著意義($p<0.0001$)。羅吉斯迴歸分析的結果顯示肥胖與年齡、性別、氏族城鄉狀態及抽菸狀態有顯著關連。自 1996 年上一次全國健康與死亡率調查以來，18 歲以上的肥胖盛行率以 280%顯著增加。結論：與 1996 年相比，馬來西亞總體肥胖盛行率非常高。急迫需要一個基於人口全面整合的介入計畫來改善馬來西亞人日益增加的肥胖問題。

關鍵字：盛行率、肥胖、氏族、馬來西亞。

The majority of obesity research among adults in Malaysia was cross sectional studies and only a small number of intervention studies, qualitative studies and systematic review were indentified. Research gaps were identified in order to make useful recommendations to the stakeholders. Conclusions. Another nationwide study was The Malaysian Cohort (TMC), which reported the prevalence of obesity among multi ethnic urban and rural Malaysians. This prospective study of the non-communicable diseases was initiated in 2005 by the researchers from the National University of Malaysia [24] and more than 100,000 respondents involved in this study. [51] reported a national prevalence of obesity in Malaysia using a systematic analysis for the Global Burden of Disease data. Rampal, L., Rampal, S., Khor, G., Azhar, M., Shafie, O., Ramlee, R., Sirajoon, N. and Jayanthi, K. (2007) A national study on the prevalence of obesity among 16,127 Malaysians. *Asia Pacific Journal of Clinical Nutrition*, 16, 561-566. has been cited by the following article: TITLE: Prevalence of and factors associated with various level of body weight among Inner Mongolia medical students in China. AUTHORS: Jiang Bian, He Yi, Zhiyue Liu, Gaimei Li, Teer Ba, Qing Zhang, Juan Sun. KEYWORDS: Body Weight; Physical Health; Medical Students; Prevalence. JOURNAL NAME: *Open Journal of Preventive Medicine*, Vol.2 No.2, May 30, 2012. ABSTRACT: Background: To date no study on the body weight of medical students in Inner Mongolia has been carried out. A national study on the prevalence of obesity among 16,127 Malaysians. *Asia Pac J Clin Nutr*.2007;16(3):561-566. 2.Bhattacharya S, Campell DM, Liston WA et.al. Effect of Body mass Index on pregnancy outcomes in nulliparous women delivering singleton babies. *BMC Public Health*. 2007;7:168. 3.Weiss JL, Malone FD, Emig D et al. Obesity, obstetric complications and caesarean delivery rate- A population-based screening study. *Am J Obstet Gynaecol* 2004;190:1091-7. 4.Kumari AS. This study examines the relationship of socio-demographic factors to physical activity among 770 adults from 3 Malaysian states. Physical activity levels were significantly related to ethnicity, gender, age, occupation and educational level. Results showed significant differences in physical activity among Malaysians based on ethnicity, gender, education, occupation and age. These results showed no significant difference in physical activity across marital statuses and, when controlling for age and education, locus of control was not significantly related to activity levels. The overall prevalence of obesity in Malaysia is very high as compared to 1996. There is an urgent need for a comprehensive integrated population-based intervention program to ameliorate the growing problem of obesity in Malaysians. A population-based cross-sectional study was conducted in all states of Malaysia with the aim to determine the prevalence of obesity among Malaysians aged fifteen years and above and factors associated. A stratified two-stage cluster sampling design with proportional allocation was used. Trained interviewers using a standardized protocol obtained the weight and height measurements and other relevant information. Subjects with a body mass index ≥ 30 kg/m² were labelled as obese.