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Obesity and Associated Health Related Factors Among University Staff in Serdang, Malaysia

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ABSTRACT

Introduction: Obesity is a well-established risk factor for coronary heart disease, ischemic stroke, type 2 diabetes, cancers of the breast, colon, prostate and other organs. **Objectives:** To determine the prevalence of obesity and associated factors among university staffs. **Methods:** A cross sectional study was carried out among university staffs of University Putra Malaysia using a self-administered validated pre-tested questionnaire. Weight was measured using a digital bathroom scale (TANITA Model HD 319) and height was measured using a SECA Body Meter Model 206. Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters (kg/m^2). A p value of <0.05 was considered to be statistically significant. Overweight was defined as a body mass index (BMI) of 25 to 29.9 kg/m^2 and obesity as a BMI of equal or more than 30 kg/m^2. **Results:** The mean age of the 454 university staffs was 42.86 years. The overall mean BMI was 24.52 ± 4.43 kg/m^2, ranged 16.12 to 36.57 (25.69 ± 3.69 kg/m^2 for males and 23.31 ± 4.81 kg/m^2 for females). The prevalence of overweight and obesity was 31.1% (40.3% males and 21.5% females) and 11.8% (12.1% males and 11.7% females) respectively. After adjusting for all the variables in the logistic regression model, gender, age, occupation, smoking, alcohol intake and physical inactivity were the main predictors of obesity. **Conclusions:** The prevalence of overweight and obesity is very high among the university staffs. There is a need for a comprehensive integrated non-communicable disease prevention program. There is also a need to establish proactive networks for building up capacity in research and training, mobilizing contributions from within the country and overseas.

Keywords: Obesity, prevalence, associated factors, university staff, Malaysia

INTRODUCTION

Overweight and obesity are defined as increased body weight for height, and body mass index (BMI) is the most common indicator of overweight and obesity [1]. Obesity is a well-established risk factor for cardiovascular disease in the general population[2, 3]. The risk of coronary heart disease, ischemic stroke, type 2 diabetes, cancers of the breast, colon, prostate and other organs grows steadily with increasing body mass. Relationship between overweight or obesity and cardiovascular morbidity, CVD mortality and total mortality has been reported by several prospective epidemiological studies [4, 5, 6, 7]. Being chronically overweight contributes to osteoarthritis - a major cause of disability[8]. A moderate decrease in weight (10% to 15%) has been shown to significantly improve the health of 90% of the obese patients[9]. It has reached epidemic proportions globally, and evidence suggests that the situation is likely to get worse. It has been estimated that 1.46 billion adults aged 20 and older, (1.41-1.51 billion) worldwide had BMI of 25 kg/m^2 or greater, of these 205 million males (193-217 million) and 297 million females (280-315 million) were obese in 2008. The mean population BMI varied substantially between nations. The age-standardized prevalence of obesity was 9.8% in males and 13.8% in females in 2008, which were nearly twice the 1980 prevalence of 4.8% for males and 7.9% for females [10]. Recent evidence shows that the prevalence of obesity has increased worldwide over the past 30 years in both rich and poor countries, and in all segments of society[10]. Malaysia is a middle income country with a multi-ethnic population. In Malaysia, the prevalence of obesity amongst Malaysians 18 years and above has increased from 4.4% in 1996 [11] to 12.3% in 2004 [12] and 14.0% in 2006[13]. As no or very little data is available on the extent of the problem of obesity in the university, this study has been conducted with the aim to determine the prevalence of obesity and factors associated with it among university staff in Serdang.

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MATERIAL & METHODS

Study Design/Study Population

A cross-sectional study was carried out among the university staffs of University Putra Malaysia. Data was collected from February 2010 to May 2010. A list of all Malaysian staff aged 30 years and above employed in UPM served as a sampling frame. The sample was selected using probability sampling technique using table of random numbers to ensure that every one had an equal chance of being chosen. The study was confined to respondents aged 30 years and above so that the results could be compared with the previous National surveys. A validated self-administered, pre-tested questionnaire on respondent's age, gender, ethnicity, educational level, hypertension status, smoking status, alcohol consumption, and physical activity was used to collect the data. Weight, height and blood pressure measurements were also recorded.

Body Mass Index (BMI)

Weight was measured using a digital bathroom scale (TANITA Model HD 319) and height was measured using a SECA Body Meter Model 206. The respondents were requested to stand barefoot on the middle of the weighing machine, with the head looking straight in front, arms by the side. When the reading of the weighing machine was stable, the weight was recorded. After each respondent, the weighing machine was reset to zero. It was checked frequently by the use of a known weight. Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters (kg/m^2). It was classified into different categories using the National Institutes of Health- National Heart, Lung, and Blood Institute clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults. In this study overweight is defined as a body mass index (BMI) of 25 to 29.9 kg/m^2 and obesity as a BMI of equal or more than 30 kg/m^2 [14].

Blood Pressure

Blood pressure was measured after the respondents had rested for at least 5 minutes using a standard mercury sphygmomanometer. The respondents were examined in a seated position with the arm placed at the heart level. Two blood pressure measurements were taken for each respondent by one of the investigators who is a qualified nurse, and the average used in the analysis. Hypertension status of the subjects was assessed based on the US Seventh Joint National Committee report on the prevention, detection, evaluation, and treatment of high BP[15]. Hypertension was defined as an average of two blood pressure readings at single occasion of systolic blood pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥90 mmHg or a self–reported diagnosis and current treatment for hypertension with antihypertensive medication and/or by self-reports of a medical diagnosis of hypertension and current treatment for hypertension with antihypertensive medication.

Smoking status

An ever smoker (includes both current and ex- smokers) was defined as a person who reported that they have smoked more than 100 cigarettes in their entire life. A current smoker was defined as someone who presently smokes daily and has smoked within the last 30 days. An ex-smoker was defined as someone who has stopped smoking.

Ethics

Before conducting the study ethical approval was obtained from the Faculty of Medicine and Health Sciences, University Putra Malaysia. Informed consent was also obtained from each respondent before data collection.

Statistical analysis

Statistical analysis was carried out using SPSS version 20.0. Independent sample t-test was used to compare the means between two groups, whereas, one way ANOVA was used to compare the means between more than two groups. Logistic regression was used to determine the main predictors of obesity among respondents. Result of logistic regression was expressed as odds ratio and 95% CI. A p value of <0.05 was considered to be statistically significant.

RESULTS

The socio- demographic characteristics of respondents by gender are shown in Table 1. The mean age of 454 respondents was 42.86 ± 9.62, and ranged from 30 to 68 years. The majority of both male and female respondents were Malays. Most of the respondents were married (84.8%), with academic position (53.7%) and had high level of income (≥ RM 6000). Among the males 19.9% were current smokers. None of the females were current smokers. The majority of the respondents (80.8%) were never smokers. The prevalence of hypertension was 34.4% (45.5% in males and 22.9% in

Table 1. Characteristics of respondents by gender

Characteristics	Male (n= 231) n (%)	Female (n= 223) n (%)	Total (n= 454) n (%)
Age (years)			
30-39	79 (34.2)	126 (56.5)	205 (45.2)
40-49	69 (29.9)	58 (26.0)	127 (28.0)
50-59	63 (27.3)	37 (16.6)	100 (22.0)
≥ 60	20 (8.6)	2 (0.9)	22 (4.8)
Ethnicity			
Malay	186 (80.5)	206 (92.4)	392 (86.3)
Chinese	30 (13.0)	10 (4.5)	40 (8.8)
Indian	15 (6.5)	7 (3.1)	22 (4.9)
Marital status			
Single	24 (10.4)	35 (15.7)	59 (13.0)
Married	206 (89.2)	179 (80.3)	385 (84.8)
Divorced	1 (0.4)	3 (1.3)	4 (0.9)
Widow	0 (0.0)	6 (2.7)	6 (1.3)
Educational level			
Primary	4 (1.7)	3 (1.4)	7 (1.5)
Secondary	44 (19.1)	69 (30.9)	113 (24.9)
Tertiary	183 (79.2)	151 (67.7)	334 (73.6)
Occupation			
Academic	152 (65.8)	92 (41.3)	244 (53.7)
Administrative	18 (7.8)	52 (23.3)	70 (15.4)
Clerical	4 (1.7)	34 (15.2)	38 (8.4)
Technician	7 (3.1)	0 (0.0)	7 (1.6)
Supportive	50 (21.6)	45 (20.2)	95 (20.9)
Income (RM)			
Low (< 3000)	46 (19.9)	53 (23.8)	99 (21.8)
Medium (3000-5999)	71 (30.7)	96 (43.0)	167 (36.8)
High (≥ 6000)	114 (49.4)	74 (33.2)	188 (41.4)
Smoking status			
Current smokers	46 (19.9)	0 (0.0)	46 (10.1)
Former smokers	39 (16.9)	2 (0.9)	41 (9.1)
Never smokers	146 (63.2)	221 (99.1)	367 (80.8)
Hypertension status			
Normotensive	126 (54.5)	172 (77.1)	298 (65.6)
Hypertensive	105 (45.5)	51 (22.9)	156 (34.4)

females). The results show that the overall mean BMI of respondents was 24.52 ± 4.43 kg/m^2, ranged 16.12 to 36.57 kg/m^2. Table 2a and 2b show the distribution of BMI by socio-demographic factors. Bivariate analysis using one way ANOVA and independent t test showed that overall mean BMI was significantly associated with age, gender, marital status, educational level and income. Males had significantly higher mean BMI (25.69 ± 3.69 kg/m^2) as compared to females (23.31 ± 4.81 kg/m^2). The mean BMI significantly increased with age among both males ($F= 14.72$, $p< 0.001$) and females ($F= 43.23$, $p< 0.001$). The results show that in males the mean BMI increased steadily till the age of 59 and then showed a decline. However, in females the mean BMI increased steadily with age. In males, the mean BMI was higher up to age 49 years compared to females. Interestingly, for respondents aged 50 and above the BMI for females was higher than the males. Using Post Hoc-Tukey test for comparing all the age groups for males showed that there was a significant difference in the mean BMI between age groups 30-39 and 40-49 ($p= 0.025$), 30-39 and 50-59 ($p<$

Table 2a. BMI distribution by socio-demographic characteristics (both gender)

	Mean	Median	95% CI	SD	F, t value	P value
Gender						
Male	25.69	25.23	25.21 - 26.17	3.69	t= 5.914	<0.001*
Female	23.31	21.85	22.67 - 23.94	4.81		
Age (years)						
30-39	22.28	21.85	21.73 - 22.83	4	F= 58.33	<0.001*
40-49	24.83	24.28	24.21 - 25.45	3.52		
50-59	28.15	27.78	27.40 - 28.89	3.75		
≥ 60	27.1	27.49	25.73 - 28.47	3.09		
Ethnicity						
Malay	24.47	23.91	24.02 - 24.92	4.51	F= 0.915	0.401
Chinese	25.34	25.24	23.99 - 26.69	4.22		
Indian	23.91	24.25	22.47 - 25.35	3.24		
Marital status						
Married	24.77	24.44	24.33 - 25.21	4.37	t= -2.768	0.007*
Not married	23.12	22.23	22.02 - 24.22	4.58		
Educational level						
Primary	21.18	20.86	17.56 - 24.80	3.91	F= 8.240	<0.001*
Secondary	25.82	25.43	24.93 - 26.71	4.77		
Tertiary	24.15	23.79	23.70 - 24.61	4.23		
Occupation						
Academic	24.71	24.45	24.21 - 25.21	3.93	t= -0.965	0.335
Non academic	24.3	23.57	23.63 - 24.98	4.96		
Income						
Low	23.75	22.78	22.83 - 24.67	4.62	F= 5.893	0.003*
Medium	24.04	23.62	23.33 - 24.75	4.65		
High	25.35	25.16	24.78 - 25.93	4.01		

* p< 0.05

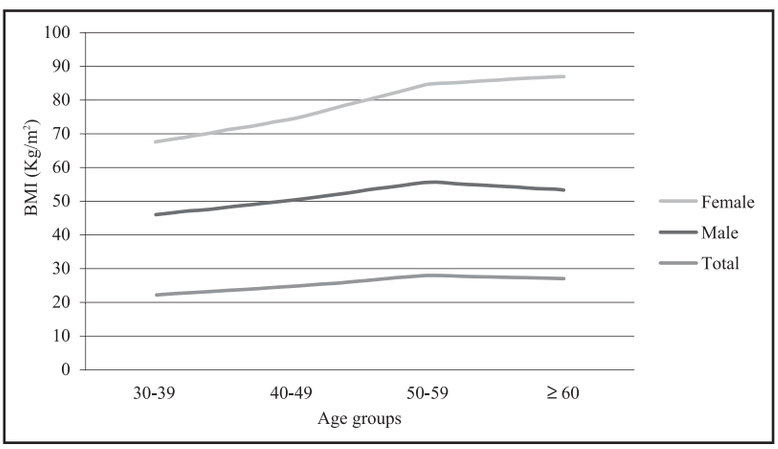

Figure 1. Distribution of Body Mass Index by Age and Gender

Table 2b. BMI distribution by socio-demographic characteristics among males and females

Characteristics	Mean	Median	95% CI	SD	F, t value	P value
Male						
Age (years)						
30-39	23.97	23.57	23.13 - 24.82	3.75	F= 14.725	<0.001*
40-49	25.57	24.64	24.83 - 26.31	3.09		
50-59	27.75	27.35	26.86 - 28.63	3.52		
≥ 60	26.45	27.16	25.34 - 27.56	2.36		
Ethnicity						
Malay	25.65	25.22	25.09 - 26.21	3.88	F= 0.731	0.489
Chinese	26.2	25.81	25.08 - 27.33	3		
Indian	25.21	24.61	23.88 - 26.54	2.4		
Marital status						
Married	25.99	25.64	25.51 - 26.47	3.5	t= 3.608	<0.001*
Not married	23.24	22.43	21.44 - 25.03	4.34		
Educational level						
Primary	22.21	23.29	14.45 - 29.97	4.87	F= 2.192	0.114
Secondary	26.18	25.9	25.00 - 27.36	3.87		
Tertiary	25.65	25.14	25.13 - 26.18	3.6		
Occupation						
Academic	25.75	25.29	25.22 - 26.27	3.24	t= 0.297	0.788
Non academic	25.59	24.64	24.60 - 26.59	4.45		
Income						
Low	24.02	23.1	22.73 - 25.32	4.37	F= 43.238	<0.001*
Medium	25.77	25.14	24.98 - 26.55	3.32		
High	26.32	26.09	25.68 - 26.96	3.43		
Female						
Age (years)						
30-39	21.22	20.48	20.55 - 21.89	3.79	F= 43.238	<0.001*
40-49	23.96	22.9	22.95 - 24.96	3.81		
50-59	28.83	29.21	27.47 - 30.18	4.07		
≥ 60	33.64	33.64	25.95 - 41.33	0.85		
Ethnicity						
Malay	23.41	22.06	22.75 - 24.06	4.78	F= 0.839	0.434
Chinese	22.75	20.32	18.31 - 27.19	6.2		
Indian	21.11	21	18.19 - 24.03	3.15		
Marital status						
Married	23.37	21.82	22.65 - 24.08	4.83	t= 0.379	0.705
Not married	23.06	22.04	21.61 - 24.51	4.75		
Educational level						
Primary	19.81	20.86	14.01 - 25.61	2.33	F= 11.595	0.010*
Secondary	25.59	25.4	24.32 - 26.86	5.28		
Tertiary	22.33	21.39	21.65 - 23.01	4.23		
Occupation						
Academic	23	21.8	22.09 - 23.91	4.37	t= 0.816	0.415
Non academic	23.52	22	22.64 - 24.40	5.1		
Income						
Low	23.51	22.17	22.17 - 24.85	4.85	F= 1.139	0.322
Medium	22.77	21.37	21.74 - 23.80	5.08		
High	23.86	23.02	22.84 - 24.88	4.38		

* $p < 0.05$

Table 3. Respondent's BMI by health-related characteristics

Characteristics	Mean	Median	95% CI	SD	F, t value	P value
Both gender						
Smoking status						
Current smoker	25.86	24.96	24.75 - 26.98	3.74	F= 7.857	<0.001*
Former smoker	26.51	26.12	25.35 - 27.66	3.66		
Never smoked	24.13	23.59	23.67 - 24.59	4.51		
Alcohol consumption						
Current drinker	24.64	24.28	22.67 - 26.61	3.55	F= 1.035	0.356
Former drinker	26.03	26.72	23.75 - 28.32	4.44		
Never drank	24.46	24.08	24.03 - 24.88	4.46		
Activity Level						
Inactive	24.88	25.32	24.08 - 25.67	4.51	F= 4.160	0.016*
Insufficiently active	23.21	22.89	22.19 - 24.22	4.48		
Sufficiently active	24.74	24.12	24.21 - 25.28	4.33		
Hypertension status						
Normotensive	22.83	22.63	22.39 - 23.26	3.8	t= 13.207	<0.001*
Hypertensive	27.76	27.75	27.17 - 28.34	3.72		
Male						
Smoking status						
Current smoker	25.86	24.96	24.75 - 26.98	3.74	F= 0.908	0.405
Former smoker	26.34	26.11	25.17 - 27.50	3.6		
Never smoked	25.47	25.14	24.86 - 26.07	3.7		
Alcohol consumption						
Current drinker	25.41	24.82	23.56 - 27.26	3.05	F= 0.315	0.73
Former drinker	26.45	26.72	24.26 - 28.64	3.62		
Never drank	25.66	25.23	25.15 - 26.18	3.74		
Activity Level						
Inactive	26.5	26.26	25.49 - 27.51	3.63	F= 1.636	0.197
Insufficiently active	25.32	26.31	24.15 - 26.48	3.06		
Sufficiently active	25.49	24.54	24.87 - 26.10	3.8		
Hypertension status						
Normotensive	24.05	23.83	23.50 - 24.61	3.14	t= 8.436	<0.001*
Hypertensive	27.66	27.49	27.01 - 28.31	3.34		
Female						
Smoking status						
Current smoker (Nil)	N.A.	N.A.	N.A.	N.A.	t= -1.941	0.054
Former smoker	29.84	29.84	0 - 70.41	4.51		
Never smoked	23.25	21.82	22.61 - 23.88	4.78		
Alcohol consumption						
Current drinker	19.62	19.62	0 - 42.19	2.51	F= 0.747	0.475
Former drinker	24.67	25.33	13.47 - 35.87	7.03		
Never drank	23.31	21.92	22.67 - 23.96	4.78		
Activity Level						
Inactive	23.74	22.59	22.64 - 24.84	4.74	F= 2.540	0.081
Insufficiently active	21.93	19.96	20.55 - 23.31	4.75		
Sufficiently active	23.64	22.11	22.69 - 24.59	4.82		
Hypertension status						
Normotensive	21.93	21.11	21.33 - 22.53	3.99	t= 9.212	<0.001*
Hypertensive	27.95	29	26.70 - 29.20	4.43		

* $p < 0.05$

0.001), 30-39 and 60 years and above (p= 0.021) and 40-49 and 50-59 (p= 0.002). However, there was no significant difference in the mean BMI between age groups 40-49 and 60 years and above and 50-59 and 60 years and above. For females a significant difference was noted in mean BMI between all age groups except between respondents who were 50-59 and 60 years and above. It was also noted that the male respondents who were married had significantly higher mean BMI than unmarried males (t= 3.60, p< 0.001), whereas, no significant association was found among females. Males mean BMI increased significantly by their income level (F= 43.23, p< 0.001). Using Post Hoc-Tukey test for males showed that there was a significant difference in the mean BMI between low and medium income (p= 0.03) and low and high income (p= 0.001), but no significant difference was found between medium and high income groups. This association was not significant among females. In addition, significant association was noted between females mean BMI and education (F= 11.59, p= 0.01). Comparing all the education groups showed that there was a significant difference in the mean BMI between secondary and tertiary groups (p< 0.001). No significant association was found between other education groups (Post Hoc-Tukey test). Table 3 shows the distribution of BMI by health-related factors. Overall, significant difference was found between mean BMI with smoking status, activity level and hypertension status. The mean BMI was significantly higher among both males (t= 8.43, p< 0.001) and females (t= 9.21, p< 0.001) who had hypertension. Table 4 shows that 31.1% (40.3% males and 21.5% females) of the respondents were overweight and 11.8% (12.1% males and 11.7% females) were obese. The majority of the respondents who were between 30-39 and 40-49 had normal weight, whereas, the majority of the respondents between 50 to 59 years old and 60 years and above were overweight or obese. Although the results showed a clear gender difference in the prevalence of overweight with more males than females, there was no significant gender difference in the prevalence of obesity. Findings also showed that 30.1% of Malays, 37.5% of Chinese and 36.4% of Indian staffs were overweight. About 12.0% of Malays, 17.5% of Chinese and none of the Indians were obese (BMI ≥ 30 kg/m2). Table 5 shows the results of the logistic regression analysis. After adjusting for all the variables in the model, gender, age, occupation, smoking, alcohol intake and physical inactivity were the main predictors of obesity.

The overall accuracy of this model to predict the subjects having obesity was 89.0% and the area under ROC curve was 77.7%. Females were 2.34 times more likely to be obese, those who were 50 years and above were 8.55 times more likely to be obese as compared to those aged below 50 years (OR= 8.552, 95% CI= 3.93 – 18. 64), non-academic staff were 2.51 times more likely to be obese as compared to academic staff (OR= 2.51, 95% CI= 1.24 – 5.10), current smokers were 3.21 times more likely to be obese as compared to never smokers (OR= 8.552, 95% CI= 1.09 – 9.48), those ever had consumed alcohol were 5.09 times more likely to be obese as compared to never consumed alcohol (OR= 5.09, 95% CI= 1.65 – 15.67) and those who were physically inactive were 2.35 times more likely to be obese as compared to those physically active (OR= 2.35, 95% CI= 1.09 – 5.05).

Table 4. Prevalence of obesity by age, gender and ethnicity

Characteristic	Underweight < 18.49	Normal weight 18.50-24.99	Pre-obese 25.00-29.99	Obese class I 30.34.99	Obese class II 35-39.99
Age					
30-39	41 (20.0)	118 (57.6)	33 (16.1)	12 (5.8)	1 (0.5)
40-49	3 (2.3)	73 (57.5)	41 (32.3)	10 (7.9)	0 (0.0)
50-50	0 (0.0)	20 (20.0)	51 (51.0)	23 (23.0)	6 (6.0)
≥ 60	0 (0.0)	4 (18.2)	16 (72.7)	2 (9.1)	0 (0.0)
Total (n= 454)	44 (9.7)	215 (47.4)	141 (31.1)	47 (10.3)	7 (1.5)
Gender					
Male (n= 231)	3 (1.3)	107 (46.3)	93 (40.3)	25 (10.8)	3 (1.3)
Female (n= 223)	41 (18.4)	108 (48.4)	48 (21.5)	22 (9.9)	4 (1.8)
Ethnicity					
Malay (n= 392)	39 (9.9)	188 (48.0)	118 (30.1)	40 (10.2)	7 (1.8)
Chinese (n= 40)	4 (10.0)	14 (35.0)	15 (37.5)	7 (17.5)	0 (0.0)
Indian (n= 22)	1 (4.5)	13 (59.1)	8 (36.4)	0 (0.0)	0 (0.0)

Table 5. Logistic regression analysis of the factors associated with obesity

Variables	β	Adjusted OR	95% CI	P value
Gender				
Male		1		
Female	0.85	2.34	1.036 - 5.289	0.041
Age Group				
30 to less than 40		1		
40 to less than 50	0.193	1.213	0.500 – 2.945	0.669
50 and above	2.146	8.552	3.924 – 18. 636	< 0.001
Occupation				
Academic Staff		1		
Non-academic Staff	0.921	2.511	1.237 – 5.096	0.011
Smoking				
Never		1		
Former	0.995	2.706	0.901 – 8.123	0.076
Current	1.166	3.209	1.086 – 9.477	0.035
Alcohol Intake				
Never		1		
Ever	1.627	5.089	1.652 – 15.673	0.005
Physical Activity				
Active		1		
Insufficiently Active	-0.136	0.872	0.252 – 3.017	0.829
Inactive	0.853	2.347	1.091 – 5.047	0.029

Nagelkerke R Square = 0.218; Hosmer and Lemeshow Test, $p = 0.197$; the overall accuracy of this model to predict the subjects having obesity was 89.0%; area under ROC curve = 77.7%.

DISCUSSION

In Malaysia, cardiovascular diseases have been the leading cause of death for the past 40 years [16]. The most important CVD risk factors are high blood pressure, obesity, high blood cholesterol, cigarette smoking, diabetes, physical inactivity and having an unhealthy reaction to stress. The prevalence of high blood pressure, cigarette smoking, diabetes, physical inactivity amongst Malaysians is high. The prevalence of hypertension amongst adults aged 30 years and above has increased from 32.9% in 1996[11] to 40.5% in 2004[16] and to 42.6% in 2006[13]. In a study carried out by Rampal *et al.* in 2010 among 1,778 school children aged 13-17 years in the Putrajaya, showed that the overall prevalence of pre-hypertension and hypertension was 11.1% and 11.6% respectively [17]. The prevalence of hypertension was significantly higher in the adolescents who were overweight or obese. The results of their study also showed that there was a significant correlation between BMI and hypertension ($r = 0.52$, $r^2 = 0.27$, $p= 0.001$) [17]. In this study overall percentage of overweight and obesity was 31.1% and 11.8% respectively as compared to the national prevalence of 29.1% and 14% [13]. In this study those who had non-academic position were more likely than staffs with academic position to be obese. It is possible that those with academic position may have more knowledge about obesity and its complications and they try to follow a healthier lifestyle as compared to the non-academic staff. Also, obese respondents were around 3 times more likely than non-obese to be smoker. Being a smoker is due to following an unhealthy lifestyle. Therefore smokers may also not pay attention to their weight status as an important factor related to their health status. This could suggest that they may not have an appropriate diet. Therefore, their energy intake and also their knowledge about a normal and balanced diet should be considered in future studies. Staffs with hypertension were around nine times more likely than normal staffs to be obese. BMI increased significantly with age, and this was consistent with previously published studies. [18, 19, 20] It is also interesting to note that among the males staff only 19.9% were current smokers and none of the females were current smokers. This is very low as compared

to the national prevalence of current smokers of 46.4% in males and 1.6% in females [13]. This could either be due to the fact that tobacco control measures taken by the university and declaring the whole university as a 'Smoke Free University' have shown results or due to under reporting as smoking is regarded as a socially unacceptable behavior in the university. The prevalence of hypertension (another risk factor for NCD) in this study was 34.4% (45.5% in males and 22.9% in females) among university staff which is lower than the national prevalence of 42.6% (41.7% in males and 43.4% in females) [13].

As the prevalence of overweight and obesity is high among the university staff, a comprehensive integrated NCD prevention program should be implemented. Meta-analyses of Randomized Controlled Trials (RCTs) have shown that a weight-reducing diet, combined with exercise, produces significant weight loss, reduces total cholesterol and LDL-cholesterol, increases HDL-cholesterol, and improves control of blood pressure and diabetes [21, 22]. A meta-analysis of RCTs found that a net weight reduction of 5.1 kg (95% CI 4.25 to 6.03 kg), resulting from restricted energy intake, increased physical activity or both, reduced systolic blood pressure by 4.44 mmHg (95% CI 2.95 to 5.93 mmHg) and diastolic blood pressure by 3.57 mmHg (95% CI 2.25 to 4.88 mmHg) [23]. There should be more intensive inter-sectoral and intra sectoral collaboration as well as community partnership and ownership. There is also a need to establish proactive networks for building up capacity in research and training, mobilizing contributions from within the country and overseas.

In conclusion, the prevalence of overweight and obesity was 31.1% (40.3% males and 21.5% females) and 11.8% (12.1% males and 11.7% females) respectively. Logistic regression analysis showed that obesity was associated with gender, age, occupation, smoking, alcohol intake and physical inactivity.

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