Original Article

PREVALENCE AND FACTORS ASSOCIATED WITH OBESITY AMONG ADULT AT THE KAMPUNG KOLAM, EAST COAST MALAYSIAN PENINSULA-A CROSS SECTIONAL STUDY

SAN SAN OO, U. S. MAHADEVA RAO*, THANT ZIN

Medical lecturers, UniSZA Medical Centre, Universiti Sultan Zainal Abidin, 20400 Kuala Terengganu, Malaysia
Email: raousm@gmail.com

ABSTRACT

Objective: This study assesses the prevalence of obesity and its associated factors among adults aged 18 y and above at the Kampaung kolam, Kuala Terengganu, Malaysia.

Methods: This cross-sectional survey comprised of a semi-structured face to face interview questionnaire and collected anthropometric measurements and sex specific waist circumference in cm. The study population was 70 in total with 21 (30%) males and 49 (70%) females aged 18 y and above were selected by universal sampling. Body mass index (BMI) was used for weight status and sex specific waist circumference (WC) in cm was used for assessment of abdominal or central obesity at risk of metabolic complications associated with obesity.

Results: Among men, the prevalence of underweight was 9.5%, normal weight 57.1%, overweight 14.3% and obesity 19.1%, while among women, the prevalence of underweight was 12.2%, normal weight 53.1%, overweight 14.3% and obesity 20.4%. Overall, 18 (25.7%) was obese and 52 (74.3%) was non-obese while sex specific WC in cm 19 (27.1%) was abdominal obese who were at risk of metabolic complication associated with obesity and 51 (72.9%) was not at risk. In chi-square association tests revealed that among respondents, currently married, unemployed and having family history with obesity were associated with generalized obesity while respondents who were currently married and having fast food frequently were associated with abdominal obesity and respondents who being currently married, unemployed and having fast food frequently were more likely to obese in generalized as well as abdominally.

Conclusion: There was no association between generalized, abdominal and generalized and abdominal obesity with age, gender, education, flat floor structure, dietary patterns and habits, physical activities, sleep pattern and knowledge and attitude level towards obesity but those factors can be utilized in effective health promotion programmers of weight management strategies by targeting those factors in design for prevention of hypertension, diabetes and related cardio vascular diseases CVD.

Keywords: Generalized obesity, Body mass index, Abdominal obesity, Dietary pattern, Physical inactivity, Sleep pattern, Knowledge and attitude level

INTRODUCTION

The term obesity and overweight can sometimes be confusing. According to World Health Organization (WHO) obesity is defined as a condition of abnormal or excessive fat accumulation in adipose tissue all over the body. Obesity can lead to the extent that health may be impaired. While overweight is describe as excessive weight that may be from extra muscle, bone, water as well as from having too much fat. Both terms mean the weight is higher than their ideal body weight that is thought to be healthy for their height. One of the most commonly used indices of relative weight to classify obesity in our study is the Body Mass Index (BMI). WHO expert consultation [1].

Obesity can be divided into general obesity and central obesity. The general obesity is defined as BMI ≥ 27 kg/m². Abdominal obesity also known as central obesity which reflecting increase in visceral fat. Prevalence of abdominal obesity is defined as waist circumference ≥90 cm for men and ≥ 80 cm for women according to WHO classification for Asian population [2].

Obesity is a serious problem as it can become a burden on the health care cost, reducing quality of life with increased incidence of chronic diseases such as cardiovascular diseases (CVD), diabetes, hypertension, stroke and some type of cancers. Despite all that it also can affect the quality of our life like difficult to move, low self-esteem, stress, depression and other emotional disturbance. Otherwise, later on they have no other choice than to seek for treatment from hospital or clinic. It can cost millions to treat which can reduce economic productivity and life expectancy of the country and its citizens. It is very truly said that "health is wealth". In conclusion, obesity is one of the most important health concerns and has a lot of complications that not only ruin a person life but also can lead to death. To improve this problem, people should be alert about it and started to solve it [3-5].

Obesity is emerging as a serious problem throughout the world, not only among adults but also children, teenagers and young adults. Obesity is a complex problem as it can lead to many other problems. It is due to various causes, factors and also may result in vast complications in our life. These factors are categorized into socio-demographics, dietary habit, lifestyle, genetic, knowledge and attitude [6].

The WHO survey in 2010 had ranked Malaysia as sixth in Asia with the highest adult obesity rate about 60% for age 18 y old and above. Deputy health minister of Malaysia said there are about 3 million obese citizens and the number keeps increasing from time to time. Yet, people still not alert or care about this problem and getting trap in obesity [7].

In the past, obesity has been surprisingly ignored as a public health problem by many nations partly due to the fact that this medical condition is seldom classified as a disease. The WHO commented that obesity should be recognized as a disease in its own right. It is now agreed that "obesity's impact is so diverse and extreme that it should now be regarded as one of the greatest neglected public health problems of our time with an impact on health which may well prove to be as great as that of smoking"[8].

The above mentioned evidence calls for doing this study to explore the prevalence and factors associated with obesity among adult aged 18 y and above at the Kampung Kolam, Kuala Terengganu, Malaysia.

MATERIALS AND METHODS

The study area was flat sri kolam which was previously known as Kampung Sri Kolam, is located in Kuala Terengganu. The total population in this flat is 130 people which consist of 59 male and 71

female. Overall, about 75% of the residents are malay, followed by 20% chinese and the least 5% were shared both by the indian and foreigner community. Flat Sri Kolam was purposely chosen for this study area based on accessibility and availability.

The sampling was done using universal sampling based on sampling frame consists of a list of people aged 18 y and above. To check the validity and reliability of these questionnaires, a pilot study had been conducted among 20 adult respondents in kampus kota, Universiti Sultan Zainal Abidin (UniSZA), Terengganu. Verbal consent had been taken from all respondents prior to the interview conducted by trained third year medical students from UniSZA. All interviewees were explained in details about full description of the research, confidentiality and voluntary participation. Those who failed to answer all questions and those who were not at home during the study period will be excluded in this study. Thirty samples were excluded and 70 samples were included according to inclusion and exclusion criteria.

Samples were collected by means of an interview-guided of a validated face to face interview semi-structured questionnaire and anthropometric measurements including waist circumference (WC) measurement. Body weight was determined to the nearest 0.1 kg on standard and calibrated weighing scales with the respondent wear light clothing and removing the shoes. Height was measured to the nearest 0.1 cm on standardized, wall-mounted height boards according to the following protocol: stand straight, no shoes, heels together, and heels, buttocks, shoulders, and head touching the vertical wall surface with line of sight aligned horizontally. BMI was computed by dividing weight (kg) by height squared (m2). WHO BMI cut-off points for Asian population was used for classification as follows: Underweight-BMI less than 18.5 kg/m2; Normal weight-BMI 18.5 to less than 23 kg/m2; Overweight-BMI 23 to less than 27.5 kg/m2; and Obese-BMI 27.5 kg/m2 and above 17. WC was measured using flexible measuring tape at the upper edge of the iliac crest and the lower edge of the lowest rib, with light clothing and in standing position. Abdominal obesity is defined by a WC greater than 90 cm for men and 80 cm for women [2].

Data analysis was done using 'statistical package for social sciences' (SPSS) version 21.0. Descriptive and statistics analytical tests were computed using this software. Statistical significance level was taken at the *p* value<0.05 with 95% confidence intervals. Data screening and exploration was done with normality test for continuous data distribution using the kolmogorov-smirnov test and found that the data was normally distributed. The continuous variables was summarized by using means and standard deviations (SD) and mostly categorized as required and presented as the number (n) and percentage (%). The statistical analysis used was pearson chi-square test for statistical difference of the categorical variables and pearson correlation test for correlation of the continuous independent and dependent variables.

RESULTS

Characteristics of respondents

A total of 70 respondents were represented in this study with 21 (30.00%) males and 49 (70.00%) females. Table 1 showed the characteristics of the respondents. Males had mean age of 46 y while females had mean age of 39 y with age distribution was mostly among 26-55 y group. Most of them were in marriage relationship (52.9%) rather than being single or had divorced or separated. In terms of educational level, 75.7% had low education (up to secondary school only) and it was similarly distributed in both genders. Almost fifty percent of the respondents were not working, however females had rather higher proportion (55.1%) rather than males whom mostly not working (33.3%).

Majority of the respondents live in lower floor level at the flat but females had higher proportion (63.3%) rather than males who living in lower floor level (57.1%). Seventy percent of

respondents come from low income family, however almost all females (89.8%) had much lower income status rather than males who come from lower income families (76.2%). With mean BMI were similar in both groups, 14.3 % of the respondents were overweight and 20% were obese; and the proportion of obese among females were higher, 26.5% compared to males, 23.8% respectively. Twenty seven percent of the respondents had abdominal obesity. Mean WC was rather normal in male group (less than 90 cm) as compared to females whom mean was in abnormal level (more than 80 cm). This was further seen in the abdominal obesity proportion that higher among females (32.7%) compared to males (14.3%). After assessing the respondents' knowledge and attitude towards obesity by asking six knowledge questions regards to obesity related co-morbidities, awareness, obesity assessment and diet related risk factor and three attitude questions refers to perceived severity, perceived benefits towards obesity, both gender got similar mean knowledge and attitude score with 23+8 and 10+4 respectively. Sixty five percent of respondents had poor knowledge and attitude status and both gender had similar proportion with (61.9%) of males and (65.3%) of females for knowledge status and (66.7%) of males and (65.3%) of females respectively.

Table 2 showed the perceived co-morbidity and perceived severity related knowledge status of the respondents by their obesity status. The questionnaire includes the obesity related co-morbidities, severity, risky dietary habit and obesity assessment methods. Based on total respondent number, majority of the respondents agreed that obesity could cause hypertension (72.8%) and diabetes mellitus (75.7%) while 68.1% and 88.9% of generalized obese people, 42.1% and 36.8% of abdominal obese and 69.3% and 92.3% of both generalized and abdominal obese agreed on that. Most of total respondents agreed that body weight reduction will reduce the risk of obesity related disease (65.8%) compared to generalized, abdominal and both obese agreed on that 88.9%, 36.8% and 84.7% respectively. The knowledge of WC was one of the method to measure obesity was agreed by most of the total respondents with percentage of 70.0% compared to almost similar proportion of generalized and abdominal obese people and rather higher distribution of both obese people (84.6%). Majority of the total respondents agreed to the facts that eating excessive fatty foods can cause obesity (87.1%) while generalized (94.4%), abdominal (42.1%) and 100.0% of generalized and abdominal obese agreed that. Sixty five percentage of total respondents agreed that the vegetables must be taken as many as half of a plate in every meal and generalized, abdominal and both obese agreed on that with 50.0%, 21.1% and 53.9% respectively. Knowledge status was categorized as poor and good knowledge level by setting itemized cutoff score 23 of total 30. Sixty four percent of overall got poor knowledge level while, almost similar distribution (53%) of generalized, abdominal and both obese people got poor level of knowledge.

Table 3 described the perceived awareness of respondents by their obesity status. The questionnaire includes awareness and prevention of obesity. Among overall respondents, majority agreed that obese people are aware of its risk (67.2%) while generalized obese (61.1%), abdominal obese (84.2%) and both obese people (76.9%) agreed on that. Most of respondents not agree the statement of "obesity are common among the society" with 57.2% compared to compared to generalized, abdominal and both obese didn't agree on that as well with 55.5%, 57.9% and 53.9% respectively. The attitude of campaign through television helps in preventing obesity was agreed by 62.8% of overall respondents and generalized (66.6%), abdominal (73.7%) and both obese (69.3%) agreed on that. Attitude status was categorized as poor and good attitude level by setting itemized cutoff score 10 of total 15. Majority of overall (65.7%) got poor attitude status compared to almost similar proportion (55%) of generalized, abdominal and both obese people got poor level of attitude.

Table 1: Characteristics of respondents by gender

Characteristics		n(%)[a]	
		Male	**Female**
		(n=21)	**(n=49)**
Age (Years)		46(19)[b]	39(17)[b]
Age group	18 to 25 (Young adult)	2(9.5)	17(34.7)
	26 to 55 (Middle age)	10(47.6)	20(40.8)
	56 and above	9(42.9)	12(24.5)
Marital status	Single	4(19.0)	22(44.9)
	Married	17(81.0)	20(40.8)
	Widow/Widower	0(0.0)	7(14.3)
Occupations	Unemployed	7(33.3)	27(55.1)
	Own	7(33.3)	4(8.2)
	employed	7(33.3)	18(36.7)
Education level	Low Education Level	18(85.7)	35(71.4)
	High Education Level	3(14.3)	14(28.6)
Income status	Below RM2000 (Low Income Status)	16(76.2)	44(89.8)
	RM2000 and above (High Income Status)	5(23.8)	5(10.2)
Floor level	Lower Floor (level 1 and 2)	12(57.1)	31(63.3)
	Higher floor (level 3 and 4)	9(42.9)	18(36.7)
BMI of respondent (Kg/m2)		24.66(6.14)[b]	24.77(6.14)[b]
BMI classification	Underweight(<18.5)	2(9.5)	6(12.2)
	Normal weight (18.5 to 24.99)	12(57.1)	26(53.1)
	Pre-obese (25 to 29.99)	3(14.3)	7(14.3)
	Obese class I (30 to 34.99)	2(9.5)	5(10.2)
	Obese class II (35 to 39.99)	2(9.5)	4(8.2)
	Obese class III (40 and above)	0(0.0)	1(2.0)
General obesity	Obese (BMI 27 and above)	5(23.8)	13(26.5)
	Normal (BMI less than 27)	16(76.2)	36(73.5)
WC of respondent (cm)		82.27(9.50)[b]	78.73(12.11)[b]
Abdominal obesity	Normal	18(85.7)	33(67.3)
	Abdominal obesity	3(14.3)	16(32.7)
Knowledge score		22(4)	23(3)
knowledge level	less than 23 (Low knowledge level)	13(61.9)	32(65.3)
	23 and above (Good knowledge level)	8(38.1)	17(34.7)
Attitude score		9(2)[b]	10(2)[b]
Attitude status	less than 10 (Poor attitude)	14(66.7)	32(65.3)
	10 and above (Good attitude)	7(33.3)	17(34.7)

[a]= Number (percentage), [b] = Mean (standard deviation), BMI = Body Mass Index

Table 2: Perceived co-morbidity and perceived severity of respondents by obesity status

	Characteristics	n(%)[a]			
		Total	**General Obese**	**Abdominal Obese**	**General and abdominal obese**
		(n=70)	**(n=18)**	**(n=19)**	**(n=13)**
Knowledge					
Obesity causes hypertension	Agree	32(45.7)	5(27.8)	8(42.1)	4(30.8)
	Strongly Agree	19(27.1)	6(33.3)	0(0.0)	5(38.5)
Obesity causes diabetes mellitus	Agree	33(47.1)	9(50.0)	7(36.8)	7(53.8)
	Strongly Agree	20(28.6)	7(38.9)	0(0.0)	5(38.5)
Body weight reduction will reduce the risk of obesity related disease	Agree	30(42.9)	9(50.0)	7(36.8)	6(46.2)
	Strongly Agree	16(22.9)	7(38.9)	0(0.0)	5(38.5)
WC is one of the way to measure obesity	Agree	31(44.3)	6(33.3)	9(47.4)	4(30.8)
	Strongly Agree	18(25.7)	8(44.4)	4(21.1)	7(53.8)
Eating excessive fatty foods can cause obesity	Agree	40(57.1)	9(50.0)	7(36.8)	8(61.5)
	Strongly Agree	21(30.0)	8(44.4)	1(5.3)	5(38.5)
The vegetables must be taken as many as half of a plate in every meal	Agree	32(45.7)	3(16.7)	4(21.1)	3(23.1)
	Strongly Agree	13(18.6)	6(33.3)	0(0.0)	4(30.8)
knowledge level	less than 23 (Poor knowledge level)	45(64.3)	10(55.6)	10(52.6)	7(53.8)
	23 and above (Good knowledge level)	25(35.7)	8(44.4)	9(47.4)	6(46.2)

[a]= Number (percentage)

Table 3: Perceived awareness of respondents by obesity status

	Characteristics	n(%)[a]			
		Total	General Obese	Abdominal Obese	General and abdominal obese
		(n=70)	(n=18)	(n=19)	(n=13)
Attitude					
Obese people are aware of its risk	Agree	34(48.6)	7(38.9)	11(57.9)	7(53.8)
	Strongly Agree	13(18.6)	4(22.2)	5(26.3)	3(23.1)
Obesity are common among the society	Strongly Disagree	6(8.6)	2(11.1)	2(10.5)	1(7.7)
	Disagree	34(48.6)	8(44.4)	9(47.4)	6(46.2)
Campaign through television helps in preventing obesity	Agree	32(45.7)	8(44.4)	8(42.1)	6(46.2)
	Strongly Agree	12(17.1)	4(22.2)	6(31.6)	3(23.1)
Attitude status	less than 10 (Poor attitude)	46(65.7)	10(55.6)	10(52.6)	7(53.8)
	10 and above (Good attitude)	24(34.3)	8(44.4)	9(47.4)	6(46.2)

[a]= Number (percentage)

Table 4 showed the dietary pattern, physical activity and sleeping pattern among total respondent, generalized, abdominal and both generalized and abdominal obese respondents. Majority had breakfast, lunch and dinner but didn't had supper and others. Majority of respondents didn't follow the standard healthy plate per meal, all consumed fast food between meals, consumed sweet drink and consumed vegetable servings inadequately but not frequently. One third and over prepared their food by frying, stir frying and grilling methods. Plain water consumption was inadequate as well. Almost all respondents were physically inactive and responded their sleeping suffering was satisfactory.

Table 4: Dietary pattern, physical activity and sleeping pattern of respondents by obesity status

| Characteristics		n(%)[a]			
		Total	General Obese	Abdominal Obese	General and abdominal obese
		(n=70)	(n=18)	(n=19)	(n=13)
Dietary pattern					
Breakfast	Yes	60(85.7)	15(83.3)	16(84.2)	11(84.6)
	No	10(14.3)	3(16.7)	3(15.8)	2(15.4)
Lunch	Yes	59(84.3)	18(100.0)	17(89.5)	13(100.0)
	No	11(15.7)	0(0.0)	2(10.5)	0(0.0)
Dinner	Yes	58(82.9)	12(66.7)	12(63.2)	7(53.8)
	No	12(17.1)	6(33.3)	7(36.8)	6(46.2)
Supper	Yes	20(28.6)	6(33.3)	4(21.1)	3(23.1)
	No	50(71.4)	12(66.7)	15(78.9)	10(76.9)
Others	Yes	6(8.6)	1(5.6)	1(5.3)	1(7.7)
	No	64(91.4)	17(94.4)	18(94.7)	12(92.3)
Styleandhabit					
Standard healthy plate per meal	Yes	10(14.3)	3(16.7)	2(10.5)	2(15.4)
	No	60(85.7)	15(83.3)	17(89.5)	11(84.6)
Fast food consumption in between meals	Yes	70(100.0)	18(100.0)	19(100.0)	13(100.0)
	No	0(0.00)	0(0.0)	0(0.0)	0(0.0)
sweet drink consumption	No intake	3(4.3)	3(16.7)	2(10.5)	2(15.4)
	intake	67(95.7)	15(83.3)	17(89.5)	11(84.6)
Vege serving	2 and below (inadequate)	60(85.7)	16(88.9)	16(84.2)	11(84.6)
	3 and above (adequate)	10(14.3)	2(11.1)	3(15.8)	2(15.4)
Frequency of having fast foods	Frequent	56(80.0)	16(88.9)	18(94.7)	13(100.0)
	Not Frequent	14(20.0)	2(11.1)	1(5.3)	0(0.0)
Cooking methods	Fry	38(54.3)	8(44.4)	7(36.8)	5(38.5)
	Stir Fry	16(22.9)	4(22.2)	5(26.3)	3(23.1)
	Grill	5(7.1)	3(16.7)	2(10.5)	2(15.4)
	Boil/Steam	11(15.7)	3(16.7)	5(26.3)	3(23.1)
Plain water	inadequate	45(64.3)	10(55.6)	13(68.4)	8(61.5)
	adequate	25(35.7)	8(44.4)	6(31.6)	5(38.5)
Physical activity					
physical activity	physically inactive	62(88.6)	17(94.4)	17(89.5)	12(92.3)
	physically active	8(11.4)	1(5.6)	2(10.5)	1(7.7)
Sleeping pattern					
Satisfaction of Sleep	Yes	58(82.9)	16(88.9)	16(84.2)	12(92.3)
	No	12(17.1)	2(11.1)	3(15.8)	1(7.7)

[a]= Number (percentage)
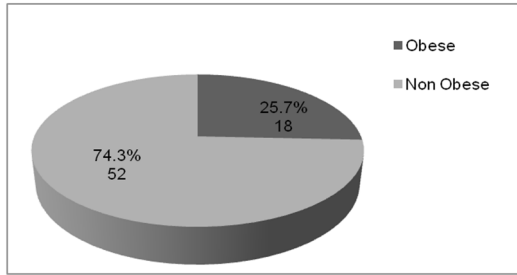
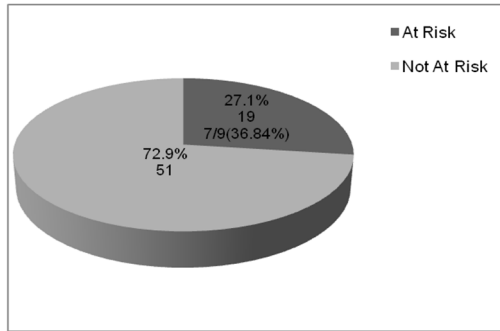**Fig. 1: Generalized obesity based on BMI**

Fig. 2: Abdominal obesity based on WC

Prevalence of obesity

Fig. (1), (2) and (3) showed the prevalence of generalized obesity in flat kampung kolam was 25.7%, abdominal obesity was 27.1%, abdominal obesity with normal BMI was 36.84% and both generalized and abdominal obesity was 18.57%.
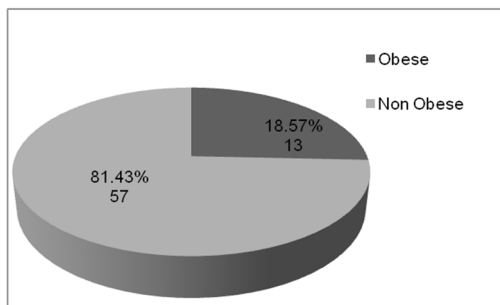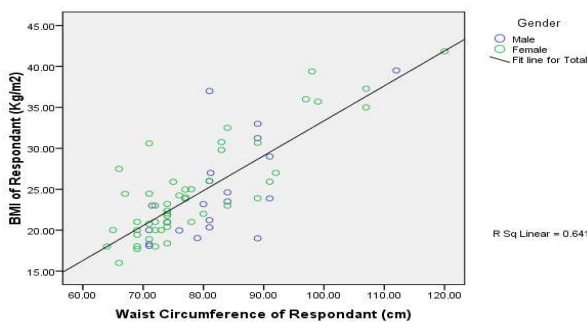

Fig. 3: Generalized and abdominal obesity

Fig. 4: Correlation between BMI and WC of respondents

Correlation between BMI and WC

There was a strong (r=0.64) and significant (p<0.001) correlation between WC and BMI as shown in fig. 4 means that the more WC had the higher BMI.

Obesity status specific analysis for associated factors

Table 5 revealed that association between socio-demographic factors and selected factors and obesity of respondents by their obesity status. Overall among 70 respondents, the people who being female, middle age, unemployed, ever married, low level educated, come from low income status, living in lower floor level, having familial obesity history, practicing unhealthy dietary habits, physically inactive and having low level of knowledge and attitude status were more prone to have all kinds of obesity rather than their counterparts groups. However, results revealed that there was statistically significant association were marital status versus obesity, occupation versus obesity, having family history of obesity versus obesity and frequency of having food versus obesity with p value less than 0.05. There was no association between physical inactivity, sleeping pattern, knowledge, attitude level and eating standard plate per meal with all obesity status. Table 5 showed the association between socio demographic profile and generalized, abdominal and generalized and abdominal obesity of the respondents. There was significant association between three obesity status and marital status (p = 0.007, p = 0.021, p = 0.013) and occupation (p = 0.019, p = 0.039, p = 0.024). There was significant association between generalized obesity and having family history of obesity (p = 0.009). There was significant association between abdominal obesity and generalized and abdominal obesity with having frequency of fast food (p = 0.054, p = 0.04) respectively but there was no significant association with age, gender, education, total family income, living level of floor, having standard healthy plate per meal, cooking method, vegetable servings, physical activity, sleeping pattern, knowledge status and attitude level of the respondents.

The respondents who currently married had higher prevalence of generalized obesity (36.4%), higher prevalence of abdominal obesity (36.4%) and higher prevalence of both generalized and abdominal obesity (27.3%) compared to unmarried respondents (7.7%), (11.5%) and (3.8%) respectively. The respondents who were unemployed had higher prevalence of generalized obesity (38.2%), higher prevalence of abdominal obesity (38.2%) and higher prevalence of both generalized and abdominal obesity (29.4%) compared to employed respondents (13.9%), (16.7%) and (8.9%) respectively. There was the prevalence of generalized obesity was highest among the respondents who had family history of obesity (50.0%) compare to who had not family history (17.3%). The respondents who having fast food frequently had higher prevalence of abdominal obesity (32.1%), higher prevalence of both generalized and abdominal obesity (38.2%) and higher prevalence of both generalized and abdominal obesity (23.2%) compared to having fast food infrequently of respondents (7.1%) and (0.0%) respectively.

Fig. 5 and 6 showed the socio-demographic characteristics and selected associated factors of abdominal obese respondents who had normal BMI. It was detected that seven out of nine (36.84%) of respondents who were abdominal obese people with normal BMI. The populations with normal BMI but with abdominal obesity are most of the time the 'neglected' population in terms of health interventions. Findings revealed that majority 80% over were being female, married, 56 y and above aged, come from low income family, unemployed, low education status, living at the flat with low high floor level and they don't have obese family members. Almost all abdominal obese people were practicing unhealthy dietary pattern in terms of not eating standard healthy plate per meal, having fast food frequently and consuming sweet drinks between meals, physical inactive, satisfied sleep pattern and having low level of knowledge and attitude towards obesity.

Table 5: Obesity status specific analysis for associated factors

Variables		General obesity			Abdominal obesity			General and abdominal obesity		
		n(%)=18		P^a	n(%)=19		P^a	n(%)=13		P^a
		Obese	N		Obese	N		Obese	N	
Age groups (Years)	18 to 25 (Young adult)	3(15.8)	16(84.2)	.507	3(15.8)	16(84.2)	.130	2(10.5)	17(89.5)	.531
	26 to 55 (Middle age)	9(30)	21(70)		7(23.3)	23(76.7)		7(23.3)	23(76.7)	
	56 and above	6(28.6)	15(71.4)		9(42.9)	12(57.1)		4(19.0)	17(81.0)	
Gender	Male	5(23.8)	16(76.2)	1.000 b	3(14.3)	18(85.7)	.148b	2(9.5)	19(90.5)	.317b
	Female	13(26.5)	36(73.5)		16(32.7)	33(67.3)		11(22.4)	38(77.6)	
Marital status	Currently married	16(36.4)	28(63.6)	.007b*	16(36.4)	28(63.6)	.021b*	12(27.3)	32(72.7)	.013b*
	Unmarried	2(7.7)	24(92.3)		3(11.5)	23(88.5)		1(3.8)	25(36.2)	
Education level	Low education level	16(30.2)	37(69.8)	.113b	17(32.1)	36(67.9)	.088b	11(20.8)	42(79.2)	.332b
	High Education Level	2(11.8)	15(88.2)		2(11.8)	15(88.2)		2(11.8)	15(88.2)	
Occupations	Unemployed	13(38.2)	21(61.8)	.019b*	13(38.2)	21(61.8)	.039b*	10(29.4)	24(70.6)	.024b*
	Employed	5(13.9)	31(86.1)		6(16.7)	30(83.3)		3(8.3)	33(91.7)	
Income status	Below RM2000 (low income status)	16(26.7)	44(73.3)	.497b	18(30.0)	42(70.0)	.178	23(21.7)	47(78.3)	.109b
	RM2000 and above (high income status)	2(20.0)	8(80.0)		1(10.0)	9(90.0)		0(0.0)	10(100.0)	
Floor level	Lower floor (level 1 and 2)	12(27.9)	31(72.1)	.406	12(27.9)	31(72.1)	.541b	8(18.6)	35(81.4)	.625b
	Highrer floor (level 3 and 4)	6(22.2)	21(77.8)		7(25.9)	20(74.1)		5(18.5)	22(81.5)	
Family obesity	Yes	9(50.0)	9(50.0)	.009b*	6(33.3)	12(66.7)	.346b	6(33.3)	12(66.7)	.069b
	No	9(17.3)	43(82.7)		13(25.0)	39(75.0)		7(13.5)	45(86.5)	
Standard healthy plate per meal	Yes	3(30.0)	7(70.0)	.501b	2(20.0)	8(80.0)	.452b	2(20.0)	8(80.0)	.506b
	No	15(25.0)	45(75.0)		17(28.3)	43(71.7)		11(18.3)	49(81.7)	
Cooking methods	Unhealthy (Fry_Stir Fry_Grill)	15(25.4)	44(74.6)	.580b	14(23.7)	45(76.3)	.133b	10(26.9)	49(83.1)	.331b
	Healthy (Boil/Steam)	3(27.3)	8(72.7)		5(45.5)	6(54.5)		3(17.3)	8(72.7)	
Frequency of having fast Foods	Frequent	16(28.6)	40(71.4)	.232b	18(32.1)	38(67.9)	.054b*	13(23.2)	14(100.0)	.04*b
	Not Frequent	2(14.3)	12(85.7)		1(7.1)	13(92.9)		0(0.0)	43(76.8)	
Vegetable serving	2 and below (inadequate)	16(26.7)	44(73.3)	.497b	16(26.7)	44(73.3)	.548b	11(18.3)	49(81.7)	.596b
	3 and above (adequate)	2(20.0)	8(80.0)		3(30.0)	7(70.0)		2(20.0)	8(80.0)	
Physical activity	physically inactive	17(27.4)	45(72.6)	.335b	17(27.4)	45(72.6)	.627b	12(19.4)	50(80.6)	.539b
	physically active	1(12.5)	7(87.5)		2(25.0)	6(75.0)		1(12.5)	7(87.5)	
Satisfaction of Sleep	Yes	16(27.6)	42(72.4)	.349b	16(27.6)	42(72.4)	.582b	12(20.7)	46(79.3)	.292b
	No	2(16.7)	10(83.3)		3(25.0)	9(75.0)		1(8.3)	11(91.7)	
Attitude status	less than 10 (Poor attitude)	10(21.7)	36(78.3)	.220b	10(21.7)	36(78.3)	.131b	7(15.2)	39(84.8)	.246b
	10 and above (Good attitude)	8(33.3)	16(66.7)		9(37.5)	15(62.5)		6(25.0)	18(75.0)	
Knowledge level	less than 23 (Low knowledge level)	10(22.2)	35(77.8)	.268b	10(22.2)	35(77.8)	.168b	7(15.6)	38(84.4)	.287b
	23 and above (Good knowledge level)	8(32.0)	17(68.0)		9(36.0)	16(64.0)		6(24.0)	19(76.0)	

n (%) = Number (Percentage), HPT = Hypertension, BMI = Body Mass Index, WC = Waist Circumference, a = Pearson Chi-Square Test, b = Fisher's Exact Test

DISCUSSION

The problem of obesity in Malaysia is arising involving all ethnics and locality. The prevalence concept of obesity can be applied by measuring generalized obesity and abdominal obesity. The generalized obesity is defined as BMI ≥ 27 kg/m². Abdominal obesity poses a major challenge to health worldwide and is associated with CVD risk. There have been few studies on obesity in the Malaysian population [6,9,10]. Prevalence of abdominal obesity is defined as WC ≥90 cm for men and ≥ 80 cm for women according to WHO for Asian population.

The prevalence of general obesity in Malaysia has increased from 4.4% in 1996 to 19.5% in 2006 with highest prevalence of 19.3% seen among adults age between 45-49 y old [11]. The generalized obesity can develop probably due to continuous urbanization, improve socioeconomic status, adaption of more sedentary lifestyle and unhealthy dietary habits in Kuala Terengganu. Unhealthy

dietary habits include eating in a large portion, skipping meals, using food to relieve stress and late night eating.

Whereas, the prevalence of abdominal obesity was 39.5% on WHO 2006 compared to 27.1% in this study [12]. It can be seen that the prevalence in the flat Kampung Kolam was lower compared to the National Health Survey prevalence due to increase awareness towards obesity in the developing country in Malaysia [13]. The prevalence of abdominal obesity is increasing in western population due to a combination of low physical activity and high energy diet and also in developing country where it is associated with the urbanization of population although there is solid evidence that body fat distribution has very significant genetic basis, Abdominal obesity will only develop in the presence of a positive energy balance. Unfortunately, because of toxic environment that human beings have designed for themselves, an increasing proportion of sedentary population and exposed to an energy-dense refined diet favouring development of obesity. As a result, this increasing tendency towards sedentary habits and an excessive intake of high energy foods are efficient promoters of abdominal obesity.
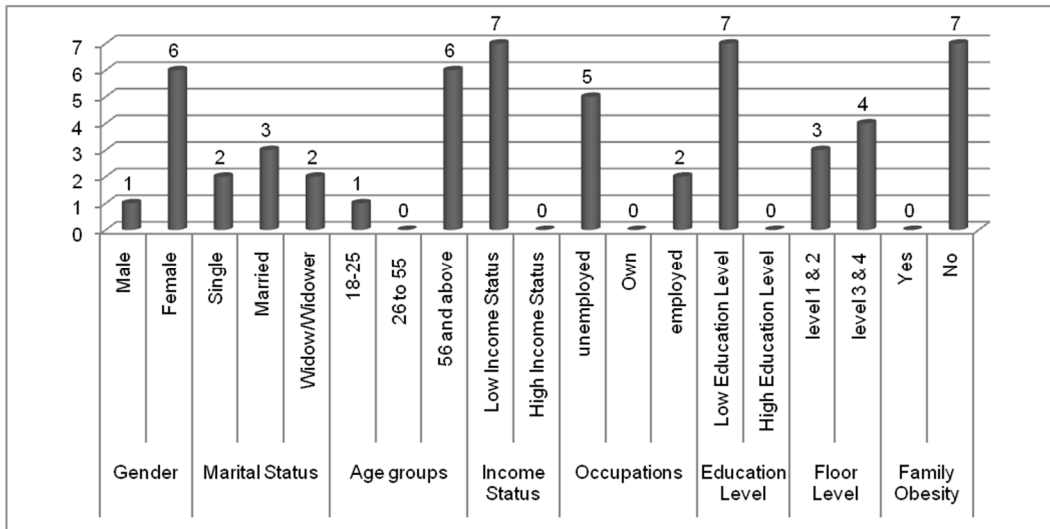

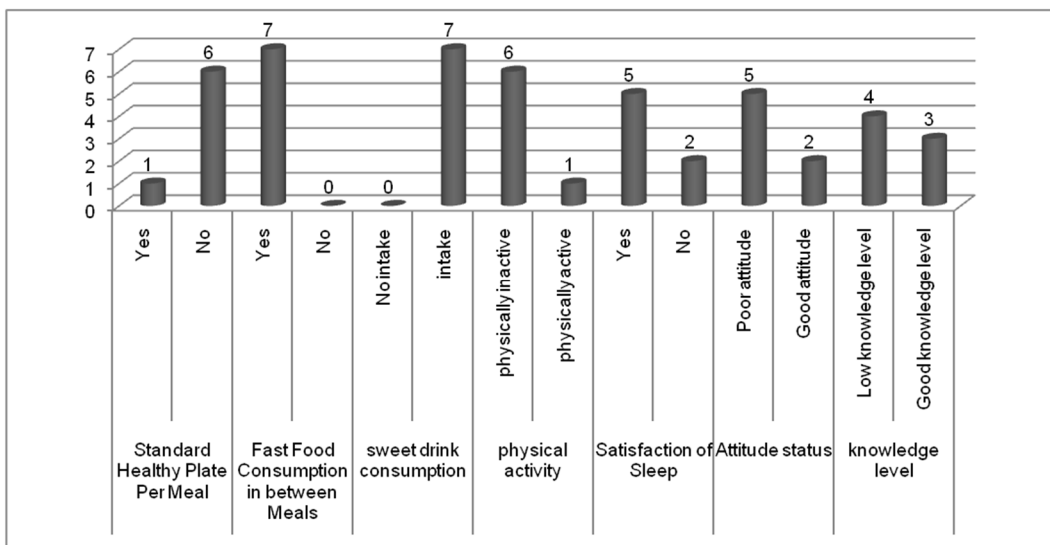**Fig. 5: Characteristics of abdominal obese with normal BMI respondents**

Fig. 6: Selected associated factors of abdominal obese with normal BMI respondents

The statistically significant associated factors for obesity found in this study were marital status, occupation, having family history of obesity and having fast food frequently. Currently married, those who were unemployed and having obese person in family and having fast food frequently were significantly related with generalized obesity, abdominal obesity and both. This study showed that marital status was significantly associated with obesity (p = 0.001), where the respondents who currently married had higher prevalence of generalized obesity (36.4%), higher prevalence of abdominal obesity (36.4%) and higher prevalence of both generalized and abdominal obesity (27.3%) compared to unmarried respondents (7.7%), (11.5%) and (3.8%) respectively. This finding is supported by Jeffery (2002) who found that marriage was associated with a significant 2-year weight gain and divorce with a significant 2-years weight loss.

The effects of marriage and divorce on weight may be due to the influence of marriage on inducement to eat (e. g., shared meals) or on motivation for weight control [14]. It was also supported by Sherina Mohd Sidik and Lekhraj Rampal who found that respondents who were married had a higher prevalence of generalized obesity (18.6%) compared to those who were still unmarried (6.9%) [15].

The second factor that is significantly related to generalized, abdominal obesity and both was occupation. The respondents who

were unemployed had higher prevalence of generalized obesity (38.2%), higher prevalence of abdominal obesity (38.2%) and higher prevalence of both generalized and abdominal obesity (29.4%) compared to employed respondents (13.9%), (16.7%) and (8.9%) respectively. There was possible reason that when someone is unemployed they tend to have less physical activity in a day which contributes to accumulation of fat in one's body [16,17].

In a study population in the Gambia done by WHO in 2001, it is found that those with a family history of obesity had a higher BMI and were at increased risk of obesity [18]. It is correlated with our research where by respondent with family history of obesity 9(50%) more likely to develop general obesity compared the one with no family history 9(17.3%), while respondent with family history of obesity 9(50%) more likely to develop central obesity compared the one with no family history 10(19.2%). Science shows that genetics plays a role in obesity. Genes can directly cause obesity in disorders such as Prader-Willi syndrome and Bardet-Biedl syndrome. However, genes do not always predict future health. According to Kopelman (2000), genetic influences of obesity may operate through susceptibility genes but the influence on non-genetic factors that exacerbated obesity [19].

In this study, there was the respondents who having fast food frequently had higher prevalence of abdominal obesity (32.1%), higher prevalence of both generalized and abdominal obesity (38.2%) and higher prevalence of both generalized and abdominal obesity (23.2%) compared to having fast food infrequently of respondents (7.1%) and (0.0%) respectively. There was a strong (r=0.64) and significant (p<0.001) correlation between WC and BMI. The findings were supported by Norafidah AR, Azmawati MN, Norfazilah A who stated that there was a strong (r=0.7) and significant (p<0.001) correlation between BMI and WC [20]. Consuming too much or too often high calorie foods and drinks may increase the total calories and thus result in obesity [21]. Commonly eaten high calorie Malaysian foods are mostly deep-fried or cooked with *santan* (coconut milk). The energy density of foods may be contributed by its macronutrient contents. A high fat food will often be labeled as energy-dense. However, sugars for example table sugar, honey, syrups also contribute to energy density. Extra sugars added to low fat confectionaries, kuih, cakes or desserts will increase the calorie content of the food. Low fat food products may also be high in calories and therefore should not be eaten in excess. Beverages containing substantial amounts of sugar or alcohol can also contribute to excessive calorie intake. Consumers are encouraged to read and compare food labels to make healthy choices [22].

Based on the survey conducted, there was no significant association between knowledge and attitude status and all kinds of obesity status, results revealed that the respondents who got high level of knowledge and attitude status had higher prevalence of generalized obesity (32.0%), (33.0%) higher prevalence of abdominal obesity (36.0.7%),(37.5%) and higher prevalence of both generalized and abdominal obesity (24.0%), (25.0%) compared to low knowledge and attitude level respondents (22.2%), (21.7%) and (22.2%), (21.7%) and (15.6%), (15.2%) respectively. This is because, those respondents with good knowledge and attitude, they are not applied appropriately in their daily practices regarding healthy diets which will lead to healthy lifestyle. The majority of the respondents appeared to have poor perceived awareness and perceived severity on complications of obesity and the respondents were not frequent checkers of their BMI and WC. Perceived obesity co-morbidity of respondents revealed in this study that majority knew obesity can lead to heart problems, hypertension and diabetes. They are more concern about their appearance and they care of others perspective towards them that lower the risk of obesity. Poor attitude regard the health concern also owing to the development of obesity. People with poor attitude had lack of concern about their appearance and they do not take into account of others perspective towards them. Although majority of the respondents perceived that junk food eaters are more prone to obesity, only a small percentage of respondents consume junk food once in a while whereas most of them consume it most of the time. This is a growing public health problem which is also stated in a study by Wyatt. *et al.* in 2006 [23].

This study could not establish any relevant relationship between other factors because of limitations of study population. In the present day, people find no time to care for their health. Likewise, the respondents who were abdominal obese with normal BMI, practicing unhealthy dietary habit and physical activity without awareness of their central obesity status, the negligence may lead to several serious diseases like diabetes, increased blood pressure, stroke, etc. It is high time to think about it and make changes in their lifestyle to have a healthy future in health promotion programme.

CONCLUSION

The results of this study found that the prevalence of generalized obesity in flat Kampung Kolam was 25.7%, abdominal obesity was 27.1%, both generalized and abdominal obesity was 18.57% and abdominal obesity with normal BMI was 36.84%. It was revealed the siocio-demographic factors such as marital status, occupation, having obese person in family and having fast food frequently were significantly associated with obesity. Seven out of thirteen (36.84%) who were abdominal obese with normal BMI practicing unhealthy eating and physical activity behavior in their daily life. The findings of this study can provide baseline data for monitoring the effectiveness of national programs for the prevention and control of obesity in Malaysia, especially among women aged 25 y and above old, currently married, unemployed, and come from low income status family with low education status. Resources for the prevention and control of obesity can be mobilized and allocated based on the factors identified to be associated with obesity. Further studies need to be done to assess the main contributing factors associated with obesity in this flat.

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CONFLICT OF INTERESTS

Declared none

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