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Determination of Elevated BMI and the Risk Factors among Medical Students of SEGi University, Malaysia

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Abstract

Objective: **Elevated BMI (overweight and obesity) is said to be one of the most common non-communicable diseases (NCD) and is beginning to be an epidemic among adults as well as in children. It is associated with higher risk of morbidity and mortality. As medical students are future doctors, who are going to be the role models for a healthy lifestyle in the community, the present study aims to determine the percentage of elevated BMI and the risk factors in the medical students of SEGi University, Malaysia.**

Methodology: **A total of 271 subjects, including Year 1 and 2 medical students of SEGi University, Kota Damansara Campus, Year 3 medical students of Teluk Intan Clinical Campus and Year 4 and 5 students of Sibu Clinical Campus had participated in this study. Students' weight and height were measured to calculate their BMI. Their blood pressure and relevant anthropometric parameters were measured. Questionnaires regarding their family medical history, eating habits, physical activities and sleeping habits were distributed and collected. From all these data, the relationship between the students' BMI and the relevant risk factors were analysed.**

Results: **It was found that 37.3% of the subjects had an elevated BMI (25 and above) and there was statistically significant difference between males (48.15%) and females (30.10%) (p=0.001). Elevated BMI is not common in Chinese students than that of Malays, Indians and other ethnic groups ($p = 0.047$). There was a significant relationship between elevated BMI and family history of overweight ($p = 0.000$) and obese ($p = 0.002$) respondents. A strong relationship was found between elevated BMI and unhealthy eating habits (increase amount and frequency of eating, consuming snacks and soft drinks frequently) ($p = 0.000$). Physical activities such as doing household chores ($p = 0.009$), physical exercise ($p = 0.000$), frequent playing of sports ($p = 0.022$) had a strong relationship with normal BMI subjects. In the elevated BMI group more students (15.8%) slept less than 5 hours per night than the normal BMI group (4.1%) ($p = 0.007$).**

Conclusion: **Among the 271 medical students of SEGi University, who had taken part in the present study, 37.3% had elevated BMI, which had a significant relationship with (1) ethnicity, (2) family history of overweight and obesity (3) unhealthy eating habits (4) less physical activities and (5) less sleeping hours.**

INTRODUCTION

Obesity has become very common among the community and is said to be one of the most common non-communicable diseases (NCD). Overweight and obesity are leading risks for morbidity and mortality. Chronic diseases such as hypertension and ischemic heart disease are attributable to obesity Body mass index (BMI) is a key index for relating weight to height. A person's BMI is calculated when a person's weight in kilograms (kg) is divided by his or her height in meter squared [1]. The term "overweight" designates a state between normal weight and obesity. BMI between the ranges of 25-30 is described as 'overweight" [2, 3]. Obesity is a condition that is characterized by excessive accumulation and storage of fat in the body and that in an adult is typically indicated by a body mass index of 30 or greater [3, 4]. Anthropometry is the study of the measurement of the human body in terms of the dimensions of bone, muscle, and adipose (fat) tissue [5]. Overweight and obesity in children is an epidemic condition internationally. Approximately 22 million children under 5 years of age are overweight all over the world [7]. Comorbidities associated with obesity is related to numerous risk factors [6,7]. Obesity is probably the most important factor in the development of insulin resistant conditions leading to diabetes [9]. Weight gain is associated with the increase in arterial pressure and leptin hormone plays a significant role in obesity related hypertension [8].

Table 1: The International Classification of adult underweight, overweight and obesity according to BMI

Classification	**BMI(kg/m^2)**	
	Principal cut-off points	**Additional cut-off points**
Underweight	**<18.50**	**<18.50**
Severe thinness	<16.00	<16.00
Moderate thinness	16.00 - 16.99	16.00 - 16.99
Mild thinness	17.00 - 18.49	17.00 - 18.49
Normal range	**18.50 - 24.99**	**18.50 - 22.99**
		23.00 - 24.99
Overweight	**≥25.00**	**≥25.00**
Pre-obese	25.00 - 29.99	25.00 - 27.49
		27.50 - 29.99
Obese	**≥30.00**	**≥30.00**
Obese class I	30.00 - 34.99	30.00 - 32.49
		32.50 - 34.99
Obese class II	35.00 - 39.99	35.00 - 37.49
		37.50 - 39.99
Obese class III	≥40.00	≥40.00

(WHO 1995, 2000 and 2004)

Sixty to seventy percent of hypertension in adults is attributable to obesity. Centrally located body fat, associated with insulin resistance and dyslipidemia, is a more potent determinant of blood pressure elevation than peripheral body fat. Some research findings reported that there is a causal link between elevated BMI and risk of ischaemic heart diseases (IHD). The public health policies that aim to reduce BMI by even moderate level could substantially reduce the occurrence of IHD in the population [9, 10, 11, 12, 13, 14].

There are also some evidences suggesting that obesity is a risk factor for developing gynaecologic and breast cancers and that a higher BMI may also adversely impact the survival in patients who develop those diseases [15,16,17,18,19,20]. The impact of obesity on reproductive function can be attributed to multiple endocrine mechanisms leading to infertility [24].

Furthermore, obesity is also related to musculoskeletal pain. Statistics released by the Center for Disease Control and Prevention (CDC) indicate that more than 31% of obese adult have arthritis. Obesity has been implicated in the development or progression of low back pain and knee osteoarthritis especially in women [21, 22, 23].

Some studies have also shown the association between obesity and a higher rate of depression especially in females [25, 26, 27, 28, 29].

The interactions between obesity and infectious diseases have recently been revealed by some studies. Emerging data have indicated an association between obesity and poor outcome in pandemic H1N1 influenza. Obesity is also an established risk factor for surgical infection, nosocomial infections, periodontitis and skin infections and are therefore required for antimicrobial dosage adjustments [30, 31, 32, 33].

As elevated BMI is the leading cause of various types of non-communicable and communicable diseases, it should be prevented among the younger generation as a public health strategy. Moreover, medical students are future doctors and hence, they are going to be the role models for a healthy life style in the community. Therefore prevention of obesity should begin from a younger age.

MATERIALS AND METHODS

This study was a cross sectional study involving a total of 271 subjects, including Year 1 and Year 2 medical students of SEGi University, Kota Damansara Campus; Year 3 medical students of Teluk Intan Clinical Campus; and Year 4 and 5 students of Sibu Clinical Campus. Those who participated in this study were students who were willing to sign the informed consent agreement.

The students' weight and height were measured to calculate their BMI. Using the BMI chart, students with elevated BMI were determined. Blood pressure and some relevant anthropometric parameters (waist, hip, wrist, elbow and mid-arm circumference) of the participants were measured.

The students were administered with questionnaires to obtain information regarding their personal data, family medical history, eating habits, physical activities and sleeping habits. From all these data, the relationship between the students' BMI and the relevant risk factors were analyzed.

Statistical analysis

Data analysis was done using the SPSS software version 21.0. Chi-Square test was used to identify the relationship between BMI and the risk factors. $P \leq 0.05$ with CI (Confidence Interval 95%) was considered as statistically significant.

RESULTS

Descriptive statistics of the subjects/ students

In the present study, 271 medical students of various ethnicities (108 males and 163 females) participated after giving their informed consent. Their age, systolic blood pressure (SBP), diastolic blood pressure (DBP), height (Hgt) in metres, weight (Wt) in kilograms, waist, hip, wrist, elbow and mid arm circumference in centimeters, BMI in weight in Kg/height in meter2 and waist to hip ratio are shown in Table 2.

Table 2: Descriptive Statistics of the subjects

		N	Minimum	Maximum	Mean	SD
Age	years	271	18.00	29.00	21.89	2.24
SBP	mmHg	271	87.00	152.20	122.20	68.34
DBP	mmHg	271	50.00	130.00	79.04	10.26
Hgt	m	271	1.50	1.88	1.69	0.82
Wt	Kg	271	36.00	145.00	64.37	16.94
Waist	cm	271	40.00	114.50	80.13	12.88
Hip	cm	271	45.00	126.00	91.84	12.79
Wrist	cm	271	11.00	25.00	15.43	1.81
Elbow	cm	271	16.00	37.75	23.76	3.34
Mid arm	cm	271	18.75	81.50	28.21	5.83
BMI		271	13.84	44.75	23.67	5.15
Waist to Hip ratio		271	0.44	1.10	0.87	0.78

N = number of students

There was a positive correlation of elevated BMI with waist circumference but not with hip circumference. The mean waist circumference among the subjects of elevated BMI group and those of normal BMI group are 95.56± S.D 8.742 cm and 78.99± S.D

4.852cm respectively. The mean hip circumference among the subjects of elevated BMI group and those of normal BMI group are 108.51± S.D 7.367cm and 94.09± S.D 4.849 cm respectively. Although the anthropometric measurements showed an increase in students with elevated BMI group, the mean waist to hip ratio is not significantly different from that of the normal BMI group (0.88 and 0.84 respectively; p = 0.126). There was also no relationship between elevated BMI and blood pressure readings (both SBP and DBP) (p= 0.225 and 0.252) among the students.

Students with elevated BMI

Among the 271 medical students who participated in the present study (108 males and 163 females), it was found that 37.3% of the subjects had elevated BMI readings (25 and above). There was statistically significant difference between male (48.15% of males, n=52) and female (30.10% of females, n=49) subjects with elevated BMI (p = 0.001).

Elevated BMI and ethnicity

There were four different ethnic groups among the research subjects which comprised of Malaysian Malays (45.0%), Malaysian Indians (22.5%), Malaysian Chinese (22.9%) and other ethnicities (international students from different countries) (9.6%). Among the Malaysian Malays, 61.5% had normal BMI and 38.5% had elevated BMI while among the Malaysian Indians, 63.9% had normal BMI and 36.1% had elevated BMI. Whereas among the Malaysian Chinese, 71.0% had normal BMI and 29.0% had elevated BMI. As for the other ethnic groups of international students, 46.2% had normal BMI and 53.8% had elevated BMI. The results showed that elevated BMI is most common in the group comprising of international students especially among most students from the Arabic Peninsula countries. On the other hand, elevated BMI was found not to be common among Chinese students as compared to that of Malays, Indians and other ethnic groups (p = 0.047).

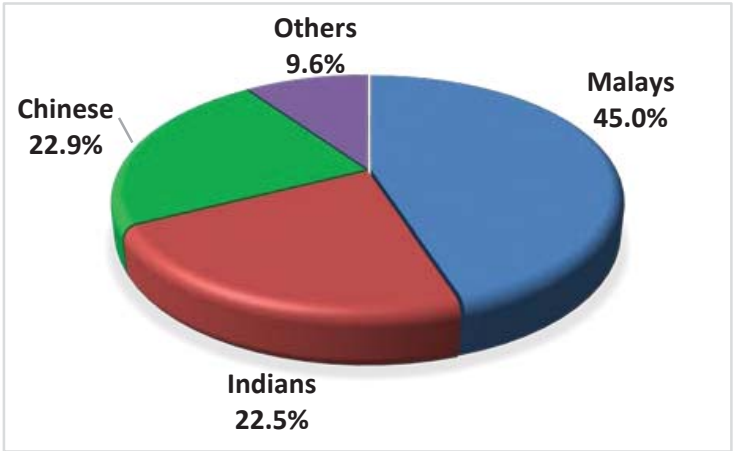

Figure 1 Percentage of Students of Different Ethnicities in the Study

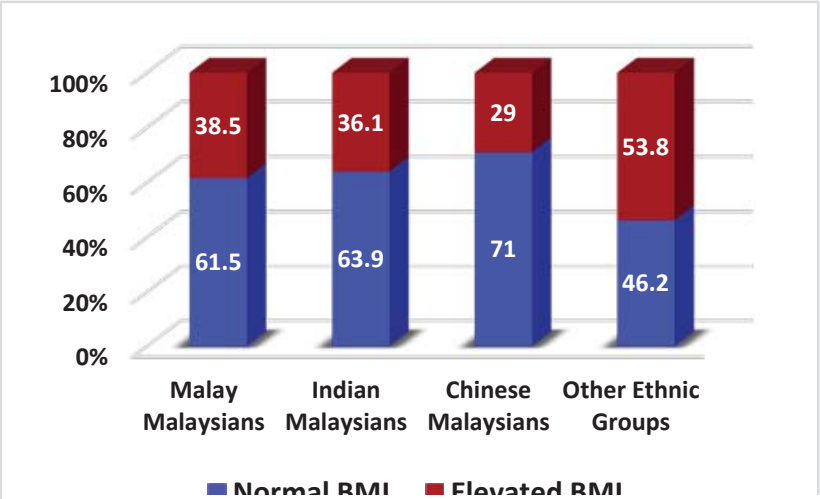

Figure 2 :Elevated BMI within different Ethnics

Elevated BMI and family medical history

It was found that there was a statistically significant difference between elevated BMI and subjects who had a family history of overweight (p = 0.000) and obesity (p = 0.002). However, there was no statistically significant difference between elevated BMI and subjects who had a family history of hypertension (p = 0.099), diabetes mellitus (p = 0.097), ischaemic heart disease (p = 0.085), cancer (p = 0.126), depression (p = 0.209) and musculoskeletal pain (p = 0.124).

Elevated BMI and eating habits

The present study showed a strong relationship between elevated BMI and unhealthy eating habits. Within the normal BMI group, 14.7% of students usually ate more than 4 times per day and within the elevated BMI group 46.5% of students ate more than 4 times per day (p = 0.000). Moreover, 5.3% of students in normal BMI group usually ate more than 2 bowls of rice per meal and 29.7% of students in the elevated BMI group usually eat more than 2 bowls of rice per meal (p = 0.000). Regarding the daily intake of snacks, 11.8% of students from the normal BMI group gave positive responses while 42.6% of students gave similar responses (p=0.000) in the elevated BMI group.

In addition, 24.1% of students in the normal BMI group consumed fast foods daily while 51.5% of students from the elevated BMI group consumed fast foods daily (p=0.000). Concerning the frequent consumption of soft drinks, 19.4% of students from the normal BMI group and 47.5% of students from the elevated BMI group responded positively (p=0.000).

Elevated BMI and physical activities

A relationship between daily physical activities and elevated BMI was also found in the present study. In the normal BMI group, 77.1% of the students carried out household chores frequently while 64.4% of students in the elevated BMI group were involved in similar activities (p=0.009). Physical exercise was frequently done by 83.5% of students from the normal BMI group and 56.4% of students from the elevated BMI group (p = 0.000). Moreover, 38.2% of students from the normal BMI group and 27.7% of students from the elevated BMI group were engaged in playing sports frequently (p= 0.022).

Elevated BMI and sleeping hours

It was also found that there was a relationship between sleeping hours and elevated BMI. In the elevated BMI group more students (15.8%) slept less than 5 hours per night than the normal BMI group (4.1%) (p = 0.007). However, there was no significant relationship with taking a nap during the day time and elevated BMI and there was no statistically significant difference between the two groups.

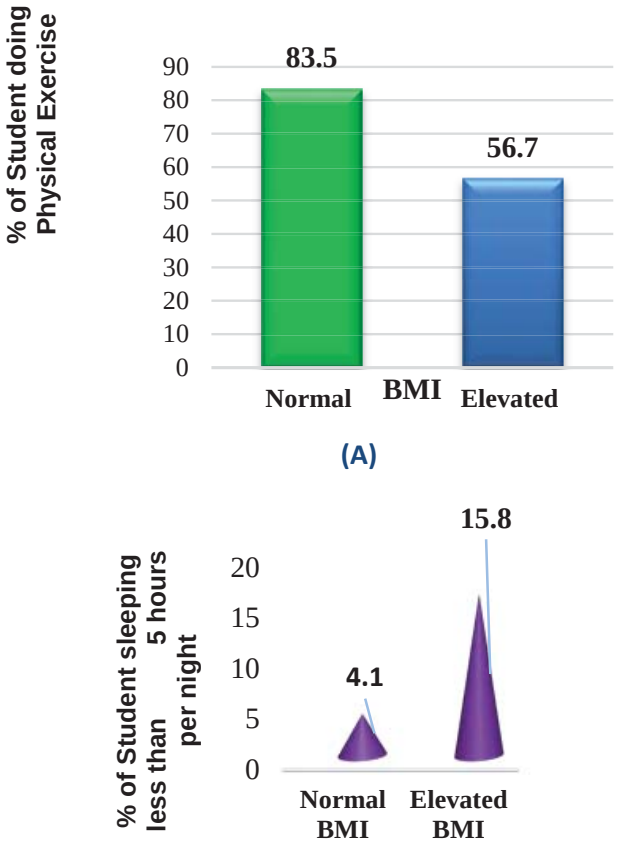

Figure 3 (A) Relationship between BMI and doing physical exercise

(B) Relationship between BMI and sleeping hours per night

Summary of the significant findings

In summary, it was found that among the 271 medical students of SEGi University who had participated in the present study, 37.3% had an elevated BMI, which had a significant relationship with the following factors:

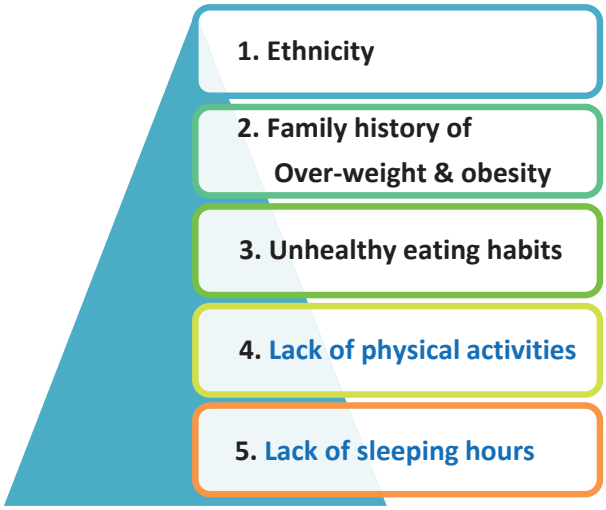

Figure 4 Factors that had a strong relationship with elevated BMI

DISCUSSION

Students with elevated BMI

It was found that among the 271 medical students, who had participated in the present study, 37.3% of them had an elevated BMI (25 and above). In actual fact, young adults (mean age 21.89 $\pm$ 2.24) of active student life should have a BMI within a normal range especially those with medical knowledge. There was statistically significant difference between male (48.15% of males, n=52) and female (30.1% of females, n=49) subjects with elevated BMI ($p = 0.001$). Females are probably more concerned about their physical appearance and fitness compared to males. Moreover, females have smaller bone structure and lighter body mass than males [24, 34].

Elevated BMI related with ethnicity and family history

Some ethnic groups had a higher percentage of elevated BMI and this may be probably related to genetics or culturally dependent food habits between each ethnic group [35, 42]. Although changes in the genetics occur too slowly to be responsible for the development of obesity, genes do play a role in the development of obesity. Most likely, genes regulate how our bodies capture, store, and release energy from food. According to "Thrifty Genotype" Hypothesis, the same genes that helped our ancestors survive occasional famines are now being challenged by environments in which food is plentiful all year round. It has been argued that the thrifty genotype is just part of a wider spectrum of ways in which genes can favour fat accumulation in a given environment. The drive to overeat (poor regulation of appetite and satiety); the tendency to be sedentary (physically inactive); a diminished ability to use dietary fats as fuel; and an easily stimulated capacity to store body fat may lead to the development of an elevated BMI. Not all people living in industrialized countries with abundant food and reduced physical activity are or will become obese; nor will all obese people have the same body fat distribution or suffer the same health issues. This diversity occurs among groups of the same racial or ethnic background and even within families living in the same environment. The variation in how people respond to the same environmental conditions is an additional indication that genes play a role in the development of obesity [42].

Many studies have shown a strong relationships between obesity and hypertension [8,10], diabetes [9,11], cardiovascular diseases [12,13,14], cancers [15,16,17,18,19,20], arthritis [21], lumbar spine diseases [22,23], gynaecological diseases [6,24,34] psychological disorders [25,26,27,28,29,], risk of infections with dosage adjustment of antimicrobial therapy [30,31,32,33] but those findings were found in middle and old aged persons. In the present study the mentioned abnormalities were not found in the young students with elevated BMI and no association was found with family history of such diseases and elevated BMI. Metabolic complications of obesity may be found with increase in age [11].

Blood pressure and elevated BMI

Associations between BMI and blood pressure (BP) have been consistently observed, but remain poorly understood [36]. The relationship between BMI and BP might be potentially confounded by dietary salt intake and physical activity levels, both of which are difficult to standardize and measure across populations in different countries. BMI is closely associated with BP in countries at different stages of socioeconomic and epidemiologic transition. Mean BP levels increase with increasing BMI categories. Although the risk of developing hypertension is higher among population groups who are overweight and obese [37], no association was found in the present study because the subjects were of younger age and young hypertensive persons are quite rare [36, 37].

Waist to hip circumference ratio

Larger waist circumference is related to accumulation of fat in central parts of the body [38]. This explains why subjects with an elevated BMI who consume a high fat diet eventually experience an increase in weight and end up with a larger waist circumference. Although there was quite a significant amount of students with elevated BMI, the mean waist to hip circumference ratio is not statistically different. It showed that their body structure is still quite proportionate as the subjects were young. Waist circumference obviously increases with advancing age leading to greater waist to hip ratio.

Elevated BMI and eating habits

In the present study there is a positive correlation with elevated BMI and the amount of food taken (more than 2 bowls of rice per meal) and frequency of main meals (4 times regularly). Eating habits may depend not only on culture, but also on the individual who then depends on leptin levels in his or her body [8, 40]. Leptin was initially believed to be an anti-obesity hormone due to its metabolic effect. The hormone leptin is produced by fat cells and is secreted into the bloodstream. Leptin reduces a person's appetite by acting on specific centres of their brain to reduce the urge to eat. It also seems to control body's storage and utilisation of fat. Obese individuals become resistant to the satiety and weight-reducing effect of the hormone for unknown reasons. As leptin is produced by fat, leptin levels tend to be higher in people who are obese than in people of normal weight. However, despite having higher levels of this appetite-reducing hormone, people who are obese are not sensitive to the effects of leptin and, as a result, tend not to feel full during and after a meal [8, 40].

People with elevated BMI may eat less frequently but their consumption of the amount of food and type of food may be probably the reasons which cause them to gain more weight. Some investigators suggested that eating small frequent meals might not only affect insulin levels, but may also affect gastric stretch and gastric hormones which contribute to satiety [39].

Elevated BMI and physical activities

It is obvious that physical activities such as doing household chores, gardening, walking, physical exercise and playing sports improves the energy expenditure and prevents weight gain. However, healthy eating habit plays a crucial role in the prevention of obesity. Physical activities are unable to prevent weight gain when there may be higher consumption of food especially with high calorie content. Sedentary life style of school children, university students and office workers also make them to precipitate weight gain [5,6,7].

Elevated BMI and sleeping hours

Students usually sleep less as they need more time for studying. However some students waste their time by participating in social media such as facebook, whatsapp, twitter etc. They have less time to sleep leading not only to impaired health but also to mismanagement of time for their routine duties.

In the present study, a correlation was found between elevated BMI and less sleeping hours of students. This is explained by the fact that sleep deprivation may alter the hormones that control hunger [8, 40]. It was reported that young men who were deprived of sleep had higher levels of the appetite-stimulating hormone ghrelin and lower levels of the satiety-inducing hormone leptin, with a corresponding increase in hunger and appetite, especially for foods rich in fat and carbohydrates [41].

A drive to overeat (poor regulation of appetite and satiety); the tendency to be sedentary (physically inactive); a diminished ability to use dietary fats as fuel leads to easily stimulated capacity to store body fat for the development of overweight and obesity with unhealthy consequences.

Prevention of elevated BMI as a national and global strategy

Obesity is assumed to be related to numerous risk factors. Although genes play a role in the development of obesity, not all people living in industrialized countries with abundant food and reduced physical activity due to sedentary work are or will become obese; nor will all obese people have the same body fat distribution or suffer the same health issues. This diversity occurs among groups of the same racial or ethnic background and even within families living in the same environment. The variation depends on how people respond to the same environmental conditions by healthy lifestyle and healthy eating habits [42]. It is crucial for a society or a country to implement as a strategic plan to prevent overweight and obesity in a community.

CONCLUSION

A significant prevalence (37.3%) of elevated BMI was found among 271 medical students of SEGi University participated in the present study. Statistical significance was found between elevated BMI and (1) ethnicity (2) family history of overweight and obesity (3) unhealthy eating habits (4) less physical activity and (5) less sleeping hours. A strategic plan is urgently needed in SEGI University for prevention of overweight and obesity among the students especially for medical students who are future doctors and are going to be the role models for healthy life style in the community.

RECOMMENDATION

Health education talks should be given in different campuses of SEGi University at least three times a year to create awareness of consequences and complications of being overweight and obese while providing tips on healthy eating habits and healthy life style. Promotion of physical activities through the formation of a good gymnasium, regular aerobic or dancing activities, regular jogging or hiking activities by appropriate groups, and frequent sports activities should be implemented throughout the year. Similar research activities should be done on students of other faculties so as to determine the percentage of elevated BMI in the university as a whole.

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