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Macro-nutrient consumption and body weight status of university students

Abstract

Objectives: The objective this study was to find out the prevalence of over-weight and obesity and the associated food consumption parameters among the university students.

Materials and methods: University students in the age range 17 – 25 years were conveniently enrolled from the campus based on their willingness and availability. This study was approved from the IIUM Research Ethics Committee, (IREC) approval ID No IREC 2018-195. In total 456 students were assessed for weight status and were categorized as under-weight, normal weight, over-weight and obese based on the WHO criteria. Furthermore, their energy, macronutrients consumption and food frequencies were recorded. Descriptive statistics were performed and association of these parameters with body weight was assessed using Pearson correlation analysis.

Results and findings: Among the students 60 were under-weight, 276 were normal weight, 96 were over-weight and 24 were obese. There was imbalance in the energy and macronutrients intakes. Food frequency of fruits and vegetables was lowest. There was significant ($p<0.001$) association of energy and macronutrients consumption to the body weight status of the students.

Conclusion: This study shows that students are consuming imbalance food with less healthier choices.

Keywords: over-weight, obese, energy, macro-nutrients, correlation

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Introduction

Students in universities are having bizarre food habits and most often it is the surrounding or the environment they dwell which provides limited choices and hence adopt unhealthy food habits.[1] This led to the problem of body weight in terms of under-weight, over-weight, and obesity among students.[2] There are various factors that can influence body weight of the university students and may end up in under-weight, over-wight or obesity. These factors include socio-economic, availability of food, personal lifestyle, study timetable, timekeeping, cooking skill, food taste, food taboo, state of mind, past food habit from adopted from sibling/family, knowledge and perception about nutritional benefit and level of physical activity. The socio-economic factors (SEF)/status of a family are the obvious factors that are affecting the nutritional status of children[3,4] and of course student in the university as well.[5] Among these factors, it appears that the financial condition of the student is the leading cause of body weight gain/loss. It has been observed that students who are cautious and well managed are able to maintain healthy body weight status[6,7] reported that income level was a significant determinant of BMI status and the students from poor family's income groups were having higher body weights compared to higher income groups. In another studied multivariate regression analysis for the prediction of body weight status among university students showed that carbohydrate, age, physical activity, anxiety, income level and smoking status have significant relationships with BMI.[8,9] The common SEF affecting body weight status are presented in the Figure 1.

The SEF of a family greatly affects food adoptions which are commonly seen among the less fortunate families it is well documented in literature that families with limited resources make poor quality and bargained food choices which may results in body weight gain.[10] The SEF affects general human performance, including our bodily and psychological/emotional health.[11] Poor SEF and the associated factors, for instance educational accomplishments[12] family members numbers lead to altered behavior,[13] deteriorated health status including under-weight, over-weight, and obesity.[14] The SEF, such as the residing environmental conditions and the place of study affect the quality of life.[15] The food selection greatly depends on the finances[16] and friends/peers and siblings of the students.[17] Furthermore, the food cooked in the neighborhood and of course availability on the campus[12] of healthy choices. The habit and environment are considered important factor in the meal selection.[18] Apart from these if the students are having skills to cook food also contribute to it.[19] This study was designed to assess the correlates of under normal, over-weight and obese students dwelling in the IIUM Kuantan Campus.

Figure 1 Socio-economic factors (SEF) contributing to nutritional status

Materials and methods

Location of the study: University students in the age range 22.05 – 22.84 years were conveniently enrolled from the campus of International Islamic University Malaysia (IIUM) Kuantan, based on their willingness and availability on the campus.

Sample Size: In total 456 students were included in this study who were residing on the campus of the IIUM Kuantan sub-campus.

Inclusion and exclusion criteria: The students residing on campus, undergraduate, healthy, and willing to participate were included in the study whereas the students residing off campus, postgraduate, having health issues and not willing to participate were excluded from the study.

Collection of data:

The data on various parameters were recorded on a simple questionnaire including having two parts. In the part a) demographic information and age, self-reported current body weight, height, BMI, BMI category (under, normal, over-weight & obese) were recorded. In the part b) types of snacks consumed per week, frequency of vegetables per week, frequency of fruits per week, frequency of fast-food per week, preference of food (grilled, steamed, fried, soup, boiled), frequency of junk food and carbonated drink per week were included. The energy, carbohydrates protein and fat intakes/day were later calculated. It is worthwhile to mention that the carbohydrates, protein, and fats intakes were recorded for three days (2 weekdays and 1 day of weekend) and the intakes were averaged for daily intakes.

Body mass index - BMI

The body weights and heights were compiled, and the BMI of the students were calculated by dividing weights (kgs) of the students over height in metres (kg/m^2).

BMI = Weight (kgs)/Height (m^2)

Compilation of data: The data were compiled from the questionnaire and various calculations were performed. After calculations of BMI the students were categorized to body weight status. The students were categorized as under-weight, normal weight, over-weight and obese based on the WHO criteria as shown in the Table 1.

Table 1 Weight status

BMI	Category
Below 18.5	Underweight
18.5–24.9	Normal weight
25.0–29.9	Pre-obesity (Over-weight)
30.0 and over	Obese

Energy and nutrients calculation:

The food frequencies per week were compiled from the questionnaire. Furthermore, their macronutrients consumption was calculated using Nutritionist Pro software using the Malaysian Dietary Guidelines (2020) composition for the food items can be accessed on https://hq.moh.gov.my/nutrition/wp-content/uploads/2021/07/Web%20MDG.pdf.

This was followed by energy calculations from the macronutrients and percent contribution of energy from the macronutrients. Furthermore, the recommended energy was calculated according to the students body age, body weight, height, physical activity level (PALs) for low active 1.4, moderately active 1.60, active 1.80 and very active 2.0 factors were used as mentioned in the Recommended Nutrient Intakes for Malaysia (RNI, 2017) can be accessed on https://hq.moh.gov.my/nutrition/wp-content/uploads/2017/05/FA-Buku-RNI.pdf

Ethical considerations: This study was approved from the IIUM Research Ethics Committee, (IREC) approval ID No IREC 2018-195.

Statistical analysis

The compiled data was processed, and analysis was performed using SPSS software. Descriptive (mean ± SD and percents) statistics were performed and association of these parameters with body weight was assessed using Pearson correlation analysis.

Results

The demographic and anthropometric

The demographic and anthropometric information of the students are presented in the Table 2. Among the students assessed for their current body weight status it was observed that 60.09 % of the students were normal weight and the rest were under, over-weight and obese based on WHO classification (WHO, 2023). Food frequencies of the students: Some of the food frequencies of the students are presented in the Table 3 and according to them the listed foods are the most preferred foods. It appears that the students are consuming less fruits and vegetables in their daily routine meals. Apart from this, their preferred foods, there were several others which are not mentioned in the Table 3. These are namely nuts, biscuits, instant noodles, chocolate bars, ice cream, chips, sausages, keropok lekor, apollos, candies, nuggets, pastries, sweets, cookies including types of snacks consumed per week, frequency of fast-food per week, frequency of junk food and carbonated drink per week. The students were having lowest frequency for healthy food items for instance boiled food items and fruits etc.

Energy and macronutrients consumption: The Tables 4,5 shows the daily consumption of energy and the percent contribution of the macronutrients to the total energy consumed. The under-weight students were consuming less energy (14.54%) compared to the other three categories (Table 4) based on the Malaysian RNI (2017). In terms of the percent contribution carbohydrates to the total energy was lower in under-weight and normal weight students. Among the obese students the percent contribution to the total energy was higher from fats (38.32%) consumption and lower from carbohydrates (46.30%) as mentioned in the Table 5.

Correlation/Association to BMI: As obvious height is significantly ($p<0.001$) associated with body weight and BMI. In these students the BMI was significantly ($p<0.001$, $p<0.01$) associated/correlated with energy, macronutrients, and the frequency of vegetables intakes whereas the frequency of fast foods was not associated with BMI (due to less frequency) as shown in the Table 6.

Discussion

Students' food choices and intakes have been a focusing of many research articles in the literature and the present study was also an effort to assess the body weight status of the university students. As mentioned earlier that the prevalence of overweight and obesity was 26.32% and at the same time underweight were 13.16 which is quite alarming. These observations among the university students have been linked to many factors one and one of the factors is bizarre kind of food habits. Some of the articles associated this bizarre kind of eating habit with the availability of food which is due to the conditions/facilities or environment with limited choices and hence lead to unhealthy food habits and lifestyle changes.[1,20] Having such scenario leads to the problem of under & overweight and obesity among the university students.[2] In the present study the prevalence of over-weight and obesity is higher than the previous study conducted in the various universities in Malaysian and reportedly it was16.3 - 23 percent.[21] The prevalence of over-weight

and obesity in this study was higher than conducted elsewhere.[22–25] As mentioned earlier, in previous studies various factors have been attributed to the weight status of university students including socio-economic, food availability on campus, lifestyle of students, classes, or study routine, timekeeping, cooking ability of students, personal taste, taboo, mental status of students, previous food exposure/habits, knowing food quality, perceived nutritional benefit of food and level of physical activity of students.[3,4,5] As mentioned before, it appears that the financial condition of the student is the leading cause of body weight gain/loss however it was not recorded in this study. Previous studies have shown that the students who are well disciplined with good income level are significantly associated with BMI status.[6,7] Whereas students from poor families have higher BMI but is related to increased carbohydrates intakes , age, physical activity, anxiety, and smoking condition.[8,9] The food adoptions/food choices and behaviors are affected by SEF [10,16] which also affects general performance, and psychological/emotional status[11,13] and with deteriorated health status.[14] Other factors, such as the residential environment[15] and money received[16] circle of friends and siblings and available cooked food.[17–19,18] When the energy contribution from the macronutrients was analyzed, it appeared that the energy from the fat sources was higher and less from carbohydrates sources compared to the RNI Malaysia (RNI, 2017). Similarly, the consumption from protein sources showed a slight increase compared to the RNI Malaysia.

Table 2 Age, body weight, height, and BMI of the students

Variables	Under-weight (Means ± SD) (N=60)	Normal weight (Means ± SD) (N = 276)	Over-weight (Means ± SD) (N = 96)	Obese (Means ± SD) (N = 24)
Age (Years)	22.05 ± 1.58	22.42 ±1.07	22.84 ±0.80	22.13 ±0.61
Body Weight (kgs)	43.63 ± 4.56	55.32 ±7.10	70.06 ±7.03	92.19 ±18.13
Height (cms)	157.68 ±7.13	159.59 ±7.10	159.82 ±7.48	161 ±8.57
BMI (meter^2)	17.49 ±0.69	21.66 ±1.81	27.38 ±1.81	35.23 ±6.94

Table 3 Some of the Food consumption frequencies among the university students

	Food Frequency/Week			
Foods (Frequency/Week)	Under-weight (Means ± SD) (N=60)	Normal weight (Means ± SD) (N = 276)	Over-weight (Means ± SD) (N = 96)	Obese (Means ± SD) (N = 24)
Vegetables	5.35 ±3.54	5.78 ±3.19	6.53 ±2.66	5.38 ±2.10
Fruits	1.35 ±1.44	2.19 ±1.74	1.85 ±1.74	1.86 ±1.94
Fried Fast-food	2.00 ±2.20	1.86 ±1.18	2.28 ±1.55	1.00 ±0.51
Junk Food	1.40 ±0.87	2.23 ±1.55	1.94 ±1.55	4.13 ±2.58
Fried Foods	0.60 ±0.49	0.66 ±0.47	0.69 ±0.47	0.88 ±0.34
Grilled Foods	0.60 ±0.92	0.67 ±0.95	0.69 ±0.96	0.25 ±0.68
Steamed Foods	0.60 ±1.21	0.36 ±0.98	0.750 ±1.31	0.38 ±1.01
Boiled Foods	2.40 ±1.98	1.78 ±1.99	1.625 ±1.98	1.50 ±1.98
Soup	0.25 ±1.10	0.33 ±1.24	0.781 ±1.83	0.00 ±0.00

Table 4 Consumption of Energy and Macronutrients among the students

Variables	Under-weight (Means ± SD) (N=60)	Normal weight (Means ± SD) (N = 276)	Over-weight (Means ± SD) (N = 96)	Obese (Means ± SD) (N = 24)
RNI (Kcal)*	1527.00 ±16	1656 ±216	1742 ±194	1671 ±289
Daily Kcal	1305.00 ±24	1663 ±262	1699 ± 363	2048 ±558
Daily Protein (g)*	53.95 ±16.58	68.57s ±16.74	80.60 ±16.64	78.79 ±24.13
Daily CHO (g)*	159.27 ±32.19	188.78 ±49.89	232.21 ±83.04	237.10 ±69.50
Daily Fats (g)*	50.20 ±16.80	70.39 ±17.48	83.11 ±18.13	87.21 ±27.74

*Recommended Nutrient Intakes for Malaysia (RNI, 2017). https://hq.moh.gov.my/nutrition/wp-content/uploads/2017/05/FA-Buku-RNI.pdf and Malaysian Dietary Guidelines (2020) https://hq.moh.gov.my/nutrition/wp-content/uploads/2021/07/Web%20MDG.pdf

Table 5 Percent energy contribution of macronutrients to the daily energy intakes

Variables	Under-weight average (%) (N=60)	Normal weight average (%) (N = 276)	Over-weight average (%) (N = 96)	Obese average (%) (N = 24)
Kcal Intakes	1305	1663	1699	2048
Daily CHO (g)	637.08 (48.86)	755.12 (48.86)	928.84 (54.67)	948.40 (46.30)
Daily Protein (g)	215.80 (16.54)	274.28 (16.49)	322.40 (18.98)	315.16 (15.39)
Daily Fats (g)	451.80 (34.64)	633.51 (38.09)	747.99 (44.03)	784.89 (38.32)

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Table 6 Correlation of Energy, Macronutrients, and Frequency of foods to BMI

Variable	Significance of the correlation with body weight	Correlation coefficient (r)	Probability value
Height	***	0.91	p<0.001
Daily Energy Intakes	***	0.67	p<0.001
Daily CHO Intakes	***	0.471	p<0.001
Daily Protein Intakes	***	0.482	p<0.001
Daily Fats Intakes	***	0.52	p<0.001
Frequency of Vegetables/Week	**	0.147	P<0.01
Frequency of Fruit/Week	NS	0.035	p=0.455
Frequency of Fast Food/Week	NS	-0.006	p=0.895

These findings shows that the students have imbalanced macronutrient intakes, particularly an increased intakes of fat at the expense of carbohydrates. The observed lower frequency of fruit and vegetables consumption among students is a matter of great concern as well. It has been reported higher intake of fruits and vegetables reduces the risk of death from heart diseases with increase of 4% additional serving per day.[26] There are numerous studies which advocate for increased intakes of fruits and vegetable for the prevention of cardiac diseases,[27–29] blood pressure[30–32] various types of cancers[27,26,33–36] diabetes[37–39] body weight[40] vision[41] and intestinal heath.[42–44] The observed imbalanced consumption of carbohydrates, proteins, and fats triggers concerns about health of the university students, as it can have repercussions in their later adult life. It is crucial to maintain a balanced diet to ensure the proper functioning of the body and to prevent potential health issues associated with excessive fat intake. To promote healthy eating habits, the students' knowledge must be enhanced on the balancing of food consumption. This well improve the quality of lives in longer terms of students and adult population in general.

Conclusions

This study shows that students are consuming imbalance food with less healthier choices from fruits and vegetables sources.

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Conflicts of interest

The author declares that there is no conflicts of interest.

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