

Association between fruit and vegetable intake and body mass index of postgraduate students at the Faculty of Health Sciences, Universiti Kebangsaan Malaysia

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ABSTRACT

Background: The Malaysian Dietary Guidelines recommended that at least two servings of fruits and three servings of vegetables be consumed daily. However, is there a relationship between daily fruit and vegetable intake and body mass index (BMI)? The aim of this study was to identify the relationship between fruit and vegetable intake and BMI among postgraduate students in the health sciences. **Methodology:** A cross-sectional study was conducted at the Faculty of Health Sciences, Universiti Kebangsaan Malaysia. 44 postgraduate students from the 2019/2020 batch of health sciences took part in this study. Respondents were asked to complete three parts of the questionnaire: socio-demographic data, anthropometric measurements, and self-administered questions. **Results:** The majority of respondents are female (n=44, 77.3%), and they are mainly Malay (n=22, 50.0%). The average BMI of all respondents is 23.76±4.83. This study found that majority of respondents did not meet the recommended daily fruit (n=31, 70.5%) and vegetable intake (n=23, 52.3%). **Discussion:** The study discovered a significant relationship (p<0.05) between age and daily vegetable intake. However, there was no significant relationship (p>0.05) between gender, age, BMI, waist circumference, and daily fruit intake. Moreover, neither daily fruit nor vegetable intake predicted changes in BMI. **Conclusion:** This study found that the consumption of fruits and vegetables among postgraduate students was unsatisfactory and lower than recommended guidelines.

Keywords: Fruit intake; vegetable intake; nutrition; body mass index (BMI); students

INTRODUCTION

Overweight and obesity are two body mass index (BMI) categories that are higher than a healthy weight at a given height and have serious health, behavioral, social, and economic consequences (Nor et al., 2019). A high BMI is also defined as a condition of an excessive accumulation of fat in the body. Nevertheless, this definition of fat accumulation has a low to moderate sensitivity as half of the adults with high fat are non-obese (Reilly et al. 2018). Overweight is defined as having a BMI between 25 and 29.9 kg/m² and obese as having a BMI greater than 30 kg/m². In 2016, it was estimated that 1.9 billion adults aged 18 and above were overweight or obese (WHO, 2018). In 2019, the prevalence of overweight and obesity in Malaysia was 30.4% and 19.7%, respectively (NHMS, 2019). It was also reported that one in every two adults in Malaysia was overweight or obese, with the proportion being highest among females, Indian ethnic groups, and people aged 55 to 59 (NHMS, 2019). Overweight and obesity are major contributors to chronic illnesses, posing significant public health challenges in the United States. Overweight and obese people are more likely to develop coronary heart disease, hypertension, dyslipidemia, type 2 diabetes mellitus, and several types of cancer (NHLBI, 2013).

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Overweight and obesity are multifactorial disorders, with one of the factors identified being insufficient dietary consumption of healthy foods such as fruits and vegetables (Wang et al., 2019, Nour et al., 2018, Tohill et al., 2004). Accumulating evidence from previous studies found that fruits and vegetables are essential for maintaining a normal BMI. A study by Heo et al., (2011) on the adult population in the United States, fruit and vegetable intake has an inverse relationship with BMI. They discovered that overweight and obese people ate significantly fewer fruits and vegetables than normal-weight people. Similarly, Wall et al. (2018) reported that children and adolescents who consumed fruits and vegetables three or more times per week had a lower BMI than those who ate them only occasionally or never. Fruits and vegetables contain many fibers, vitamins and minerals that help to maintain a normal body weight by promoting good intestinal function (Albenberg & Wu, 2014) and increasing cholesterol absorption for excretion (P Choudhary & S Tran, 2011). Fruits and vegetables, which are high in fiber and water, may also have a satiating effect, lowering calorie intake and body weight (Hakim et al., 2018a). Kiwi, strawberry, apple, pear, bitter melon, beetroot, eggplant, and fenugreek leaves are some examples of high-fiber fruits and vegetables (Dhingra et al., 2012).

According to the Malaysian Dietary Guidelines (2010), adults should consume more than two and three servings of fruit and vegetables, respectively. However, 95% of Malaysian adults do not consume the recommended daily amount of fruits and vegetables (NNHMS, 2019). Despite the fact that fruits and vegetables have long been known for their ability to protect against a variety of diseases and have been well promoted for their benefits, global consumption of fruits and vegetables has remained low (Miller et al., 2016). The prevalence of overweight and obesity varies depending on household income and education level. University students have a lower BMI than some college and high school students, as Ogden et al., (2017) reported. However, Kabir et al., (2014) discovered that nearly one-third of postgraduate students are overweight or obese. This unexpected finding could be due to low dietary quality and lack of physical activity among young adults (Demory-Luce et al., 2004). Postgraduate students are expected to practice good eating habits as representatives of a well-respected society with sufficient knowledge of healthy and nutritious foods. However, their eating habits remain unclear.

The prevalence of overweight and obesity among university students, particularly postgraduate students, in relation to fruit and vegetable intake remains to be elucidated, as the majority of studies have only been conducted among secondary school students (Ziaei et al., 2019, Ishak et al., 2016, Majid et al., 2016). Therefore, it is vital to address the current trend of fruit and vegetable intake among postgraduate students at higher learning institutions in relation to BMI. The present study aimed to determine the relationship between fruit and vegetable intake and BMI among postgraduate students at the Universiti Kebangsaan Malaysia (UKM). This current study is also keen to know their demographic status, which may influence their fruit and vegetable intake as well as their BMI. Consequently, a future intervention study to improve their nutritional status and evaluate the need for nutritional education for university students can be planned.

METHODOLOGY

This cross-sectional study was carried out at the Faculty of Health Sciences, Universiti Kebangsaan Malaysia (UKM), Kuala Lumpur. In this study, 44 postgraduate students from the 2019/2020 batch were recruited as respondents. The respondents were chosen using a convenient sampling technique. Students aged 20 to 59 years old and non-vegetarians were included as inclusion criteria in this study. Students who were full-time vegetarians, engaging in a specific diet plan programme to lose weight, or involved in any food replacement or weight loss product, on the other hand, were excluded from this study. All information was given to each student before the study began. The present study adhered to the guidelines outlined in the Helsinki Declaration of 1964. As part of their agreement to participate in this study, all respondents signed a written consent form. The respondents

were informed that their data would be collected anonymously, and they could terminate at any time. Questionnaires were directly given to the respondents.

The questionnaire is categorized into three sections: A, B, and C. Section A contained seven questions about socio-demographic information (age, gender, ethnicity, salary, marital status, vegetarian or non-vegetarian status, and occupation). Section B contained four questions about anthropometric data (weight, height, BMI, and waist circumference). Section C contained food frequency questionnaires adapted from the nutrition division of the Department of Health, Kuala Lumpur, as part of the 2015 fruit and vegetable intake survey. The ethical clearance from the UKM Ethical Committee has been obtained prior to the study (JEP-2020-541).

Statistical analysis

The Statistical Package for Social Sciences (SPSS) version 22.0 was used to analyse the data. The pattern of fruit and vegetable intake was examined using a descriptive analysis. The Fisher exact test was used to determine the relationship between fruit and vegetable intake and gender, race, and BMI. Binary logistic regression was used to determine the association between fruit and vegetable intake and BMI. All data were presented as mean \pm standard error of the mean (SEM), with $p < 0.05$ is considered significant.

RESULTS

Demographic data

This study analysed 44 completed questionnaires from first-year postgraduate students (2019/2020), Faculty of Health Sciences, UKM. The demographic information of the respondents is shown in Table 1. The majority of respondents were female ($n=34$, 77.3%) and the majority were Malay ($n=22$, 50.0%), followed by Chinese ($n=12$, 27.3%) and Indian ($n=6$, 13.6%). Three-quarters ($n=33$, 75.0%) of the respondents were between the ages of 21 and 30, with the remainder being between the ages of 31 and 40. There were only 12 married respondents (27.3%).

Table 1: Demographic data of participants

Characteristics	Frequency (n)	Percentage (%)
Gender		
Male	10	22.7
Female	34	77.3
Ethnic		
Malay	22	50.0
Chinese	12	27.3
Indian	6	13.6
Indigenous	3	6.8
Others	1	2.3
Age		
21-30	33	75.0
31-40	11	25.0
Marital Status		
Married	12	27.3
Not married	32	72.7
Working Status		
Student	29	65.9
Working	15	34.1
Income		
< RM 1000.00	25	56.8
RM 1000.00-RM 2999.99	4	9.1
RM 3000.00-RM 4999.99	7	15.9
RM 5000.00-RM 6999.99	8	18.2

BMI, waist circumference, and intake of fruit and vegetable

Descriptive analysis of BMI status shows that the majority of respondents were in the normal range for BMI status ($n=28$, 63.6%),

followed by overweight (n=7, 16%), underweight (n=4, 9.1%), obese type1 (n=3, 6.5%), and obese type2 (n=2, 4.5%) (Figure 1). It was also discovered that more than half of our respondents have normal waist circumference (n=25, 56.8%) rather than abdominal obesity (n=19, 43.2%) (Figure 1). Overall, the average mean BMI of respondents was $23.80 \pm 4.83 \text{ kgm}^{-2}$ with a minimum BMI of 15.60 kgm^{-2} and a maximum BMI of 36.42 kgm^{-2} . This data indicates that the respondents have a normal BMI on average. However, when it came to the frequency of fruit and vegetable intake among postgraduate students, this study found that the majority of respondents did not meet the recommended daily fruit intake (<2 servings, n=31, 70.5%) and recommended daily vegetable intake (<3 servings, n=23, 52.3%) (Figure 1).

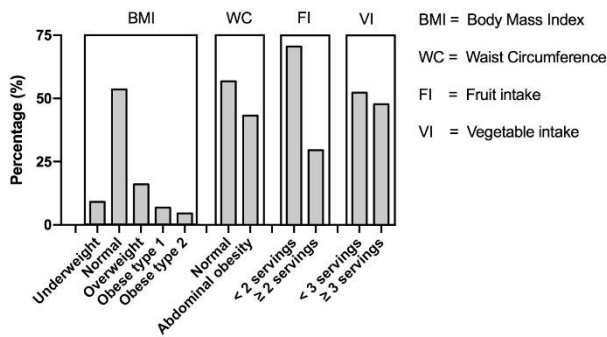


Figure 1: Descriptive analysis on BMI categories, waist circumference, and intake of fruit and vegetable among postgraduate students

Relationship of gender, age, BMI and waist circumference with fruit intake

The Fisher exact test was performed to examine the relationship between gender, age, BMI status, and waist circumference and daily fruit intake (Table 2). Due to the small sample size in this study, BMI status was further grouped into two categories: normal and not normal, which included underweight, overweight, obese type 1, and obese type 2. There is no significant relationship between gender (p=0.449), age (p=0.057), BMI (p=0.172), waist circumference (p=0.361), and daily fruit intake among postgraduate students, according to the findings (Table 2).

Table 2: Relationship of gender, age, BMI status and waist circumference with daily fruit intake

	Daily Fruits Intake		p value
	< 2 serving	≥ 2 serving	
Gender			
Male	6 (60.0%)	4 (40.0%)	0.449
Female	25 (73.5%)	9 (26.5%)	
Age			
21-30	26 (78.8%)	7 (21.2%)	0.057
31-40	5 (45.5%)	6 (54.5%)	
BMI			
Normal	22 (78.6%)	6 (21.4%)	0.172
Not normal	9 (56.2%)	7 (43.8%)	
Waist Circumference			
Normal	17 (68.0%)	8 (32.0%)	0.749
Abdominal obesity	14 (73.7%)	5 (26.3%)	

Relationship of gender, age, BMI and waist circumference with vegetable intake

The Fisher exact test was also performed to examine the relationship between gender, age, BMI status, and waist circumference and daily vegetable intake (Table 3). From table 3, the data showed that there was a significant relationship between age and daily vegetable intake (p<0.05). Respondents between the ages of 31 and 40 are more likely to consume the recommended amount of daily vegetable intake, according to the Malaysia Dietary Guideline 2010. Besides that, no significant

relationship was found between gender (p=0.155), BMI (p=0.533), waist circumference (p=0.361), and daily vegetable intake among postgraduate students (Table 3).

Table 3: Relationship of gender, age, BMI status and waist circumference with daily vegetable intake

	Daily Vegetables Intake		p value
	< 3 serving	≥ 3 serving	
Gender			
Male	3 (30.0%)	7 (70.0%)	0.155
Female	20 (58.8%)	14 (41.2%)	
Age			
21-30	21 (63.6%)	12 (36.4%)	0.017*
31-40	2 (18.2%)	9 (81.8%)	
BMI			
Normal	16 (57.1%)	12 (42.9%)	0.533
Not normal	7 (43.8%)	9 (56.2%)	
Waist Circumference			
Normal	15 (60.0%)	10 (40.0%)	0.361
Abdominal obesity	8 (42.1%)	11 (57.9%)	

Relationship of fruit and vegetable intake with normal BMI

A binary logistic regression was performed to determine the relationship between normal BMI status and daily fruit and vegetable intake (Table 4). The reference category of daily fruit and vegetable intake was set at more than 2 servings and more than 3 servings, respectively. From table 4, both daily fruit intake (B=1.020, S.E.=0.688, p=0.138) and daily vegetable intake (B=0.489, S.E.=0.650, p=0.452) were non-significant predictors (p>0.05) of normal BMI among postgraduate students. Thus, there was no relationship between fruit and vegetable intake and BMI in this study.

Table 4: Relationship of daily fruits and vegetables intake and normal BMI

Variables	B	SEM	Wald	p value	Exp(B)
Daily fruit intake	1.020	0.688	2.199	0.138	2.773
Daily vegetables intake	0.489	0.650	0.567	0.452	1.631
Constant	-0.382	0.638	0.358	0.550	0.683

SEM: Standard Error

DISCUSSION

In this study, the majority of postgraduate students in health sciences did not consume the recommended two servings of fruits per day by the Malaysian Dietary Guideline (2010), and less than half of respondents consumed the recommended three servings of vegetables per day. According to the National Health Morbidity Survey, fruit intake among Malaysian Adults fell from 14.6% in 2011 to 9.9% in 2015 (NHMS, 2015), which was also explained by the results of this current study. Aziz et al., (2019) and Izzah et al., (2012) discovered similar results, with the majority of respondents failing to consume the recommended amount of fruits and vegetables. Individual attitudes, eating habits, social influence, and the availability of fruits and vegetables all influence fruit and vegetable consumption (Othman et al., 2012). Several studies have reported that most university students do not consume the recommended amount of fruits and vegetables (Alsunni & Badar, 2015; Hassan et al., 2015).

Fruit and vegetable intake varies according to socio-demographic characteristics. Some studies have shown that females consume more fruits and vegetables than males (Darfur-Oduro et al., 2018, Othman et al., 2012). Although it is speculated that females are more concerned about a healthy diet compared to males, with more fruits and vegetables

consumed (Yen et al., 2015, Othman et al., 2012), our study found insufficient evidence, which could be due to the imbalanced proportion of sample size in males and females, with more females than males involved in this study. Intake of fruit and vegetable increases with age due to health conditions and concerns (Othman et al., 2012). This study found that only the age range of 31-40-year-old consumed enough vegetables but not fruits. This finding may also be due to the majority of respondents in this study were young adults.

The result of our study shows that there is no significant relationship between fruit and vegetable intake and BMI. This result was consistent with the findings of Field et al., (2003) and Hakim et al., (2018a). The daily intake of fruits and vegetables has also been found to have no effect on waist circumference. According to Kaiser et al., (2014), there is insufficient evidence to suggest that increasing fruit and vegetable intake will result in weight loss. Studies by Clemens et al., (2015) and Hakim et al., (2018b) also found no link between total fruit intake and BMI, waist circumference, and fat content. Our study found that both daily intake of fruit and the daily intake of vegetables are not significant predictors of normal BMI. Thus, there was no relationship between fruit and vegetable intake and BMI. Our findings are in accordance with a previous study by Kaiser et al., (2014), which found no significant effect on body weight of increasing fruit and/or vegetable intake in isolation from other interventions for more than 8 weeks. Obesity prevention required a combination of increased fruit and vegetable intake, and decreased consumption of other energy sources (Kaiser et al., 2014, Mytton et al., 2014).

There are several limitations that could hinder the outcome of this study. First, because this was a cross-sectional study, a causal relationship could not be established. The questionnaire may not accurately reflect the daily intake of fruits and vegetables by the respondent. Furthermore, fruit and vegetable intake was estimated using self-administered questionnaires that depend on memory recall, resulting in bias and inaccuracy. Finally, because of the small sample size, this study may not be able to detect some statistical difference, and the results may not reflect the population as a whole.

CONCLUSION

In conclusion, fruit and vegetable intake among postgraduate students was unsatisfactory, which is lower than the 2010 Malaysia Dietary Guidelines recommendation. Besides, fruit and vegetable intake is unrelated to BMI because fruits and vegetables are not indicators of maintaining a normal BMI. Knowledge and promotions of the health benefits of fruit and vegetable consumption are essential in encouraging students to increase their intake for healthy body function.

DISCLOSURES

The authors declare that there is no conflict of interest.

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