INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES

Vol 14, Issue 12, (2024) E-ISSN: 2222-6990

Assessing Energy and Macronutrients Intakes of University Students

Kamal Izuwan Ramli[1], Noor Suhaila Yusof[2]

School of Tourism, Hospitality and Event Management, College of Law, Government and International Studies, Universiti Utara Malaysia, 06010 Sintok, Kedah, Malaysia

Email: [1]izzuwan@uum.edu.my, [2]nsuhaila@uum.edu.my

Corresponding Author Email: izzuwan@uum.edu.my

To Link this Article: http://dx.doi.org/10.6007/IJARBSS/v14-i12/23881 DOI:10.6007/IJARBSS/v14-i12/23881

Published Date: 25 December 2024

Abstract

Eating a healthy diet is essential for students' academic success and general well-being. However, some students face difficulties as they move from living with their parents to living independently on campus. Academic pressure and the cost and availability of healthy food have been shown to have a detrimental effect on students' life and, consequently, their food choices. A total of 337 respondents were interviewed for this study, including 296 female and 41 male university students. The nutritional intakes of the students residing on campus were collected using the 24-hour dietary recall (24HR). The findings revealed that male students surpassed their total energy intake (TEI), but both genders exceeded their RNI for protein and fat. Research on Malaysian adults indicates that the majority of Malaysians did not follow the RNI, and this study demonstrates that students did not follow the RNI either. This indicates that nutrition education should begin at a young age.

Keywords: 24 Hour Dietary Recall (24Hr), Energy Intake, Fat Intake, Recommended Nutrient Intake (RNI), Protein Intake, University Students

Introduction

Many studies have been conducted to examine the changes in students' lifestyles as they enter university life and how this affects their lives, particularly their eating habits. Parents, particularly those concerned about their own and their families' well-being, will undoubtedly be concerned about their children's eating habits. However, once these children reach adolescence and enrol university, nobody monitors their dietary choices and eating habits. Furthermore, a shortage of nutritious food options, as well as a lack of time owing to lecture schedules and other curriculum obligations, have led students to skip meals and consume more snack foods (Driskel, Kim, & Goebel, 2005). Furthermore, earlier studies indicated that students who live away from their parents have poorer eating habits than those who live with their parents (Angeliki et al., 2007). In addition, many of the university students ignore health maintenance and promotion, resulting in an unhealthy lifestyle and an unbalanced dietary

consumption. Additionally, a hectic schedule and heavy academic have led to inappropriate dietary choices (Tao et al., 2022). Studies have shown that many adolescents moving away from home and stay at university may exhibit several health-related behavioural changes, including the adoption of unhealthy eating habits (Mueller et al., 2018). This behaviour is feared to be carried through their later life.

It is essential to understand the dietary practices of this group, particularly those who just recently entered a new stage of life, as any habits formed at this time may be carried over to later years (El Ansari, Stock, & Mikolajczyk, 2012). Their food consumption may be impacted by a number of factors during this crucial time of their lives, including changes that allow them to make their own food choices (Angeliki et al., 2007), irregular meal patterns (Tao et al. 2022), high reliance on convenience food (Papier et al., 2015), as well as budgetary constraints (Deliens et al., 2016). This study addresses the issues that university students that do not meet the recommended nutritional intake. While many studies have shown that non-adherence to dietary recommendations can lead to non-communicable diseases (NCDs) (Ezzati and Riboli 2013, Asghari et al., 2016), other research on students has shown that poor eating habits can negatively impact academic performance (Florence, Asbridge, & Veugelers 2008). Drawing attention to these problems may highlight the specific dietary intervention strategies for this vulnerable population.

This study can help students understand the importance of healthy eating. Other than that, the study's findings could be used to help university administrators better understand students' dietary needs, particularly in terms of providing affordable yet healthier food options and raising healthy eating awareness among this population. This study adds to the body of literature by drawing attention to the issue of students' nutritional intakes, particularly with regard to the energy and macronutrient intakes of Malaysian students. It made clear about how critical it is to address this population's adherence to dietary recommendations, as prompt action is required to support a healthier and more productive future generation.

Literature Review

Students' Food Choice and Nutritional Intakes

It is well known that when young people join university, their eating habits and dietary intakes changes (Dyson and Renk 2006). University students who are not living with their parents were found to have developed unhealthy eating habits as compared to those who stay with their parents (Papadaki et al., 2007). Studies (such as El Ansari, Stock and Mikolajczyk, 2012; Spanos and Hanket, 2010; Jaworowska and Bazylak, 2007; Chourdakis et al., 2007) claimed that university students are accustomed to irregular meals, high-energy fat snacks, and drinks or desserts. In addition, the healthy way of life is hampered by the study hours, which can vary from day to day.

The university-age population, which is primarily between the ages of 18 and 24, is also known as late-adolescents or young adults (Deforche et al., 2015; McDonagh et al., 2018). During this period of time, this population is going through major changes in physical, mental, emotional, and social lifestyles, as well as food habits (Mueller, 2018). Therefore, it is critical to explore how university students choose their meals and to see whether meet it their daily nutritional requirements. This study can provide critical insight on the students' eating patterns as well

as the nutritional value of the foods that these students consume on a regular basis. Furthermore, unhealthy eating habits and preferences may have a negative impact on students' overall health.

Earlier studies have found that the nutritional intakes of majority of university students did not meet the recommended macronutrient and micronutrient intakes (Shimbo et al., 2004; Sanlier and Unusan, 2007). Furthermore, they also tend to have poor eating habits such as consuming fewer vegetables and fruits, prefer fatty foods, skipping meals, and also have less physical activities (Abolfotouh et al., 2007). A more recent study among Malaysian students found that university students were practising unhealthy snacking behaviour (Mithra et al., 2018) and unhealthy snacking has become an issue of public health (Asghari et al., 2016) because it has been identified to be one of the risk factors for metabolic syndrome and diet-related non-communicable diseases (NCDs) (Ezzati and Riboli 2013, Asghari et al., 2016).

After enrolling in university, students must be independent and make their own dietary choices based on their preferences. This alteration of their typical routine leads to the change of their food pattern and lifestyle, which has an impact on their health (Wilson et al., 2016). In the university setting, student diet patterns vary depending on their family background, lifestyle, and surroundings. Most university students endure rapid weight gain as a result of their bad eating habits (Wilson et al., 2016; Roy et al., 2017). Wilson et al. (2016) asserted that, while students may wish to eat healthier and make better food choices, they are unable to do so due to a lack of knowledge and self-efficacy. As a result, students are more likely to prefer convenience foods, which can lead to an unhealthy diet and a higher risk of disease.

Several factors have been identified as contributing to students' unhealthy food choice and eating habits. The selection of unhealthy foods, higher cost of getting healthy food and the ease and availability of fast foods may have brought a negative impact to the students' overall diet (Gan et al., 2011). Students' food choices may be influenced by this consumer group's possible lack of awareness regarding food's nutritional values (Kolodinsky, 2019). On top of that, stress and academic pressures often lead students to make convenience-driven decisions, increasing their consumption of fast food and processed snacks (Papier et al., 2015). Students encountering difficulties such as meeting deadlines, budgetary restrictions, and the availability of food options around them may have also led them to make inappropriate dietary choices (Deliens et al., 2016). Furthermore, it is worth noting that it has been discovered that students at universities are particularly sensitive to gaining a lot of weight quickly within a short time (Yang et al., 2016). Furthermore, the evolution of age from childhood in school to university brought various health consequences that are directly related to the pattern of food consumption, which leads to nutritional concerns in their later life (El Ansari, Stock, & Mikolajczyk, 2012). Given all of the highlighted issues, it is critical to look into the students' dietary intakes. The results of this study could be useful in determining the true nutritional values that these students are consuming while living on campus.

Malaysia has been frequently identified as a country with an alarming obesity rate. According to Ng et al. (2014), 48.3 percent of men and 48.6 percent of women in Malaysia are obese, while the Malaysian National Health and Morbidity Survey (NHMS) 2015 reported that 30 percent of individuals in Malaysia are overweight, with 17.3 percent obese (Institute for Public Health, 2015). In addition, Malaysian National Health and Morbidity Survey (NHMS) 2019

stated that one in two adults is Malaysia were overweight or obese, where majority of them were females (54.7%). In term of age group, 60.9 percent of Malaysians between 55 to 59 percent were either overweight or obese. According to survey by Lee and Wan Muda (1999), 30.8 percent of Malaysians are overweight, with 22 percent classified as obese. In addition, it has been reported that majority of Malaysian adults have either met or exceeded the RNI for protein and fat (NCCFN 2021). According to the National Health and Morbidity Survey 2023 (NHMS 2023), obesity is becoming more prevalent in Malaysia. Obesity rates among Malaysians increased from 44.5 percent in 2011 to 47.7 percent in 2015, 50.1 percent in 2019, and 54.4 percent in 2013 (Institute for Public Health, 2024). Given the prevalence of overweight and obesity in Malaysia, it is critical for Malaysians to be aware of their dietary intakes, particularly their calorie intake.

Unhealthy eating habits and preferences may have a negative impact on students' overall health. According to Niyaz (2020) and Maugeri et al. (2022), university students are among the risky population because their diet options are limited, they consume high-calorie and high-fat foods, they engage in limited physical activity, and emotional changes (primarily anxiety and depression) have influenced their food intake and eating behaviour. As a result, this study is significant since it provides a more in-depth insight of the students' nutritional intakes, which has been shown to carry over into their future lives. Furthermore, the survey's data on nutritional intakes will assist the university in developing an intervention strategy to boost students' food intake.

Methods

Subjects

A total of 337 respondents were interviewed in this study. Respondents were all university undergraduate students aged 20 to 24 years old who lived on campus. 41 male and 296 female students were interviewed. The interviews were carried out during the term time. They were all residing in university-provided hostels, and all of the students obtained their food on campus. None of the students consumed food that were prepared by their parents prior to the interview.

The 24-hour Dietary Recall (24HR)

A 24-hour dietary recall (24HR) is a method that is commonly used for assessing an individual's food and beverage consumption over the previous 24 hours. Typically, a systematic interview or questionnaire is used to gather specific information regarding portion amounts, preparation techniques, and meal time. In this study, the students that voluntarily participated in the 24HR interview procedure had to list every meal and beverage they had consumed in the previous 24 hours. However, because this method is heavily reliant on the participants' ability to recall all of the food they had consumed, it is probable that some foods or meals from that 24-hour period were forgotten. Furthermore, the capacity to recall food intake varies greatly from one person to another, particularly among men, therefore accuracy of the 24HR is difficult to accomplish (Conway, Ingwersen, & Mosfegh 2004). To overcome this, the USDA devised a five-step multiple pass approach as a potential answer to this issue (Conway et al., 2003). The steps were said to be able to enable researchers reliably assess participants' consumption of calories, protein, carbohydrate, and fat regardless of their BMI (Conway, Ingwersen, & Mosfegh 2004), hence this study employed this strategy for the accuracy of data obtained.

Data Analysis

After the 24HR interviews were completed, all data were screened to ensure that it met the criteria for completeness and to eliminate under-reporters. The current study's criteria were based on the work of Casey et al., (1999), who established the following minimum requirements for completeness: (a) individual foods were remembered for each eating occasion, (b) descriptive details were provided for at least 75% of all foods reported, and (c) quantities were provided for at least 85% of all foods reported. The Nutritionist Pro software was used to analyse the data collected from the 24HR. Respondents' mean energy and macronutrient consumption, as well as the percentage of energy consumed by carbohydrates, protein, and fat, were compared to total calories. The data were presented as mean intake, standard deviation, and frequency. The nutritional intakes extracted were compared to the Malaysian Recommended Nutrient Intake (RNI) (NCCFN, 2017). Given that all of the respondents in this study were students aged 20 to 24 years old, all of the Total Energy Intake (TEI), Estimated Energy Requirement (EER), and Recommended Nutrient Intakes (RNI) were based on Malaysians aged 19 to 29 years old, as classified by the RNI for Malaysians 2017 (NCCFN, 2017).

Results

Total Energy Intakes (TEI)

This section provides the data from the 24HR about the amount of calories consumed by the undergraduate students. The comparisons were made based on Physical Activity Level (PAL) 1.6 as suggested in the RNI for Malaysians 2017 (NCCFN, 2017).

Table 1
Total energy intake (TEI) to estimated energy requirement (EER) percentage (N = 337)

	Total Energy Intake (TEI) (kcal/day)	Estimated Energy Requirement (EER) [a]	TEI % to EER
Male	2532.9	2240	113.1%
Female	2095.9	2080	100.8%

[a] For measuring the general population, the energy requirements have been based on Physical Activity Level (PAL) 1.6 based on the recommendation by RNI for Malaysians 2017 (NCCFN, 2017).

Table 1 compares the total energy intake (TEI) of male and female students to their estimated energy requirements (EER) for Malaysians (NCCFN, 2017). Results showed that TEI for male students exceed the EER by 13.1% indicating that the male students consume more energy than their EER. However, the TEI for female respondents was found to be very close to EER at 100.8%, indicating that female students consume energy close to their estimated needs. This implies that the male students are likely ingesting excess calories, whilst females maintain adequate intakes.

However, the survey also revealed that 20 out of 41 (48.8%) of male students' intake did not meet the requirements for EER. On average, their energy consumption was 18.42% below the recommended level. In the case of female students, approximately one-third, or 103 out of 296 (34.8%), did not consume enough calories in their regular diet. On average, their energy intake was 19.24% lower than the EER for females of their age.

Carbohydrates

This section presents the students' average carbohydrates intake. The amount of carbohydrates intakes are expressed in grams per day (g/day). The estimation to total calorie intakes from carbohydrates were calculated based on 4 kilocalories per gram of carbohydrate (NCCFN, 2017). The values were then expressed as a percentage to the TEI of each group. According to RNI Malaysia 2017, carbohydrates should account for 50 to 65 percent of TEI (NCCFN, 2017).

Table 2
Mean intake of carbohydrate and total energy intake (TEI) from carbohydrates

	Total Energy Intake (TEI) (kcal/day)	Average Carbohydrates intake (g/day) (mean ± SD)	% of total energy intake (TEI) from carbohydrates [a]
Male	2532.9	255.9 ± 102.1	40.42%
Female	2095.9	223.8 ± 81.7	42.73%

[a] Calculated based on 4 kcal/gram of carbohydrate (NCCFN 2017)

Table 2 presents the total energy intake (TEI), carbohydrate consumption, and the proportion of carbohydrates to energy intake for male and female students. The survey results revealed that male students consumed 225.9 grams of carbohydrate per day, accounting for 40.4 percent of TEI. When compared to Malaysians' RNI, carbohydrates should make up 50 to 65 percent of their daily energy consumption. This demonstrates that male students consume more total carbohydrates in grams however obtained a smaller percentage of their overall energy from carbohydrates, implying a higher intake of fats and proteins. Female students consumed an average of 223.8 grams of carbohydrates, accounting for 42.71 percent of their total energy intake (TEI). This suggests that female students consume less carbohydrates in grams yet rely on carbohydrates for a greater proportion of their total energy intake compared to male students.

Overall comparisons of male and female students revealed that male students consume more carbohydrates but rely less on carbohydrates for energy. Females, on the other hand, consume fewer calories and carbohydrates while deriving a higher proportion of their energy from carbohydrates, indicating nutritional differences between the two groups. However, it is vital to note that neither of them met Malaysia's RNI, which states that carbohydrate should account for 50 to 65 percent of total energy intakes (NCCFN 2017).

Protein

According to the RNI for Malaysia 2017 (NCCFN 2017), protein should provide 10-20% of total energy intake (TEI). The estimation of calories derived from protein is calculated based on 4 kilocalories per gram of protein (NCCFN 2017). These numbers were then compared to the amount of RNI (g/day) for each age group, with gender differences taken into account. Finally, the percentage of excess protein intakes was calculated using a comparison of each group's average intakes and their respective RNIs.

Table 3
Mean intake of protein and total energy intake (TEI) from protein

	RNI (g/day)[a]	Total Energy Intake (TEI) (kcal/day)	Average protein intake (g/day) (mean ± SD)	% of total energy intake (TEI) from protein [b]	Excess protein intake to RNI [c] (%) [d]
Male	62	2533.0	84.6 ± 34.9	13.36%	22.6 (136.42%)
Female	53	2095.9	77.5 ± 32.2	14.80%	24.5 (146.32%)

[a] Source: NCCFN 2017
[b] Calculated based on 4 kcal/gram of protein (NCCFN 2017)
[c] Average protein intake differences between (g/day) and RNI (g/day)
[d] The difference (in percentage) between average intake of protein (g/day) and protein RNI (g/day)

Table 3 represents the findings about the mean protein intake and total energy intake (TEI) for male and female students, comparing actual intakes to recommended nutritional intakes (RNI). Results from data analysis revealed that both male and female students exceeded their RNIs, with total protein intakes of 84.6 and 77.5 grams per day, respectively. The analysis also revealed that female students had a higher percentage of excess (146.32%) than their male counterparts (136.42%). Overall, results showed that both genders consume more protein than the RNI, with females consuming more.

Fat
The calories derived from fat are estimated using 9 kilocalories per gram of fat (NCCFN, 2017) and are presented as a percentage of dietary fat intake to TEI. The excess fat intakes of each group were compared to the Malaysian RNI's upper level of recommended dietary fat intake. According to RNI Malaysia 2017, it is recommended that 25 to 30% of TEI comes from fat.

Table 4
Mean intake of fat and total energy intake (TEI) from fat

	RNI (g/day)[a]	Total Energy Intake (TEI) (kcal/day)	Average fat intake (g/day) (mean ± SD)	% of total energy intake (TEI) from fat [b]	Excess fat intake to RNI [c] (%) [d]
Male	62-75	2533.0	105.4 ± 40.4	37.50%	30.4 (140.5%)
Female	51-61	2095.9	85.4 ± 33.9	36.67%	24.4 (140%)

[a] Source: NCCFN 2017
b Calculated based on 9 kcal/gram of fat (NCCFN, 2017)
[c] Average fat intake differences between (g/day) and RNI (g/day)
[d] The difference (in percentage) between average intake of fat (g/day) and fat RNI (g/day)

Table 4 indicates the average fat intake of male and female students in comparison to their RNI. Results from the survey showed that male students consumed an average of 105.4 grams of fat per day, which exceeds the upper RNI (75 gram per day) by 30.4 grams (140.5%). On the other hand, female students' diet consist of 85.4 grams of fat per day, which exceeds the upper RNI (61 grams) by 24.4 grams (140%). The overall comparison found that both genders

exceeded the recommended daily fat intake, particularly males. Fat overconsumption is particularly concerning because it can lead to diet-related health problems.

In addition to protein, both male and female students exhibit excessive consumption of fat. It was found that male students' fat intake was 37.5% and female students' TEI was 36.67%. The recommended consumption of fat should be limited to 30% of TEI (NCCFN, 2017) to avoid unhealthy weight gain (Nishida et al., 2004).

Discussion

One of the most significant aspect of a university student's life is their diet. Healthy diet is not just to maintain their health, but will also have an impact on their academic achievement (Florence, Asbridge, & Veugelers 2008). The 24-hour dietary recall approach was used in this study to gather data regarding the nutritional values of the foods consumed by the students. Protein, carbohydrate, and fat consumption have all been related to an increased risk of developing cardiovascular diseases (CVD) (Brandhorst and Longo 2019). Subsequently, dietary habits, including composition, calorie consumption, and eating habits, are important factors influencing ageing and chronic diseases (Murray and Lopez 2013). Therefore, it is crucial to assess the dietary intakes of university students. Overall findings from the study demonstrated that the students' dietary intakes did not correspond with the Malaysian RNI. According to the study's findings, male students consumed 13 percent more energy than the EER. Even when the amount exceeded is not substantial, a persistent excess of energy consumption has been linked to CVD and other dietary issues (El Ansari, Stock, & Mikolajczyk, 2012; Murray and Lopex. 2013; Brandhorst and Longo, 2019). However, almost half of the male students (48.8%) and on-third of the female students (34.8%) were found to have an energy intake that is lower that the recommended EER. One possible explanation for this issue is that about 70 percent of university students are from low-income families (Ajos, 2024). According to Abdul Jalil et al., 2020(a) on average, university students in Malaysia have around RM579.70 for their monthly expenditure and most of their monthly allowances are being spent on food. Despite the fact that this amount appears to be substantial, the students' income is deemed rather low, barely meeting the self-sufficiency standard [Abdul Jalil et al., 2020 (b)]. According to Ukegbu et al., (2019), students who receive bigger amount of allowance may have more choices in terms of food selection and can allocate more of their money on food. As a result, the more ability the students have in purchasing food, the more likely they will purchase more nutritious foods (Anderson and Butcher, 2016). On the contrary, those with lower socioeconomic status were found to exhibit lower adherence to good eating behaviours and therefore have poorer health outcomes Domosławska-Żylińska (2023). Furthermore, students are unable to afford nutritious foods (Bruening et al., 2016), making it difficult to maintain a healthy diet (Rainville and Brink, 2001).

Despite the fact that the percentage of energy intake from protein remains within the recommended level, both male and female students consumed an excess of protein (per grams) by 36.4 percent and 46.3 percent, respectively. When comparing energy intakes, it is clear that these students relied more on protein than carbohydrate for their source of energy. Excess protein intakes has been shown in studies to cause more harm than good. Excess protein consumption, according to Pesta and Samuel (2014), increases the acid load on the kidneys, and animal proteins are associated with high-fat content. According to a study by Lagiou et al. (2012), raising protein intake by 10% (or 5 g protein) while reducing carbohydrate

intake by 10% (or 20 g carbohydrates) is linked to a substantial increase in CVD incidence. Dietary intakes that replace carbohydrates with animal protein result in a change in the total protein to carbohydrate consumption ratio, which has been linked to poorer health outcomes (Lagiou et al., 2012). Diets high in animal protein and fats and low in carbohydrates have also been linked to an increased mortality rate (Fung et al., 2010). Also, many protein-rich animal-derived foods such as red meats, dairy, and poultry are also high in saturated fats and cholesterol (Pesta & Samuel 2014). This may increase the risk of heart disease, hyperlipidemia (high level of triglyceride and cholesterol on blood), and hypercholesterolemia (high in blood cholesterol level) in people who consume a high-protein diet (Hu et al., 1997).

According to studies, excess fat consumption has been associated with an increased risk of developing a variety of health complications. As is widely accepted, fat has been identified as a major contributor to weight gain and obesity. In Malaysia, studies have discovered a link between a high-fat diet and the development of CVD risk factors such as diabetes, high cholesterol, and hypertension. It has been established that consuming diets high in fat, particularly those associated with high energy, and engaging in little physical activity raises the risk of obesity and increases the risk of chronic diseases like such as diabetes and hypertension (WHO, 2003).

Deliens et al., (2016) highlighted that students are facing a lot of stress during their studies and this has led them to make inappropriate dietary choices. With regard to this, studies by Mikolajczyk, El Ansari, and Maxwell (2009) and Zellner et al., (2006) reported that stress causes people's cortisol levels to rise, which leads to an increase in the consumption of high-fat meals as a coping mechanism. This may explain the amount of fat consumed by the students that participated in this study. Furthermore, it was discovered in this study that male students consumed more fat than female students. The claim stated by Papier et al., (2015) that stress is a more important predictor of male students' poor diet choices supports the findings from the current study. Similarly, Vidal et al. (2018) increased fat intake was linked to increased stress levels, and this relationship was more significant in male than in female students.

The students’ adverse eating habits indicate that actions need to be taken to improve their dietary intakes. Education is the key to assisting these students in making better dietary choices. Studies such as Worsley (2002), Mazier and McLeod (2007), and Yahia (2016) have found that the increase in nutrition knowledge among university students could significantly help them improve in making healthier food choices. Furthermore, it was found that students have lack of awareness in term of nutritional values in foods (Kolodinsky, 2019). Therefore, providing them with sufficient nutritional knowledge could help them making more informed choices.

Conclusion

This study demonstrates that maintaining a healthy diet is a challenge for university students. According to the nutritional intake data, male students in particular consume more energy than female students. Apart from that, it was discovered that the students' intakes of fat and protein were higher than the RNI. The results of this study can be explained by examining earlier research where these problems were linked to a number of variables, including student stress levels, affordability, and accessibility to healthful foods. The majority of college

students were from low-income families. Therefore getting healthier meals seemed to be a challenge for these students. Stress level among university students are inevitable. Previous studies have proven that the stress factors have brought significant impact on students' dietary choices. However, educating the students is the key to help them make healthier food choices. This will not only benefit them physically, but it may also improve their academic performance. Given the prevalence of rising obesity rates in Malaysia, it is important that awareness of healthy eating is being taught to these students so that they may incorporate good eating habits into their daily life. According to research on Malaysian adults, most Malaysians did not adhere to the RNI, and this study shows that students did not either. This study suggests that nutrition education could be done at an earlier stage, especially in universities. There are some drawbacks to this study. There is an imbalance in the number of respondents by gender in this survey. Nonetheless, the bigger number of of female participation reflects the university's student population and is consistent with the gender composition of the previous studies (American College Health Association, 2013; Yahia et al., 2014). Furthermore, this study did not directly examine the influence of nutritional awareness and improved diet among students. Although this problem has been investigated in prior studies, no similar study has been conducted in the context of Malaysian university students. The study's expansion could provide light on whether nutritional education considerably improves nutrient intakes among Malaysian university students.

Acknowledgements

The authors are grateful to everyone who contributed to the successful completion of this research study. This work was supported by Universiti Utara Malaysia under the University Research Grant (SO Code: 13425).

References

Abdul Jalil. N., Rambeli, N., Hashim, A., Hashim E., & Zulkifli, N. (2020)(a). The Income-Expenditure-Saving Analyses of the University Students. *International Journal of Psychosocial Rehabilitation*, *24*. 7375-7383. 10.37200/IJPR/V24I7/PR270706.

Abdul Jalil, N., Ramli, N, Mohammed Gamal, A.A., Gan, P.T., Abdul Karim, N-A., Saidin, S.Z. (2020)(b). The Income-Expenditure Pattern of University Students: A Measure on Degree of Importance of Expenditure Items. *Journal of Critical Reviews*, *7*(6), ISSN- 2394-5125

Abolfotouh, M. A., Bassiouni, F.A., Mounir, G. M. Fayyad, R. C. (2007). Health-related lifestyles and risk behaviours among students living in Alexandria University hostels. *Eastern Mediterranean Health Journal*, *13*, 376-391.

Ajos, E. G., (2024, September 20). 70 peratus pelajar UUM kumpulan B40, kurang mampu. *Berita Harian*. https://www.bharian.com.my/berita/nasional/2024/09/1300823/70-peratus-pelajar-uum-kumpulan-b40-kurang-mampu

American College Health Association (2013). National College Health Assessment II: Reference Group Executive Summary Spring 2013

Anderson, P. M., & Butcher, K. F. (2016). *The Relationships Among Snap Benefits, Grocery Spending, Diet Quality, and the Adequacy of Low-income Families' Resources*. Washington, DC: Center on Budget and Policy Priorities.

Angeliki, P., Jane, G.H., Scott, A., Kapsokefalou, M. (2007). Eating habits of university students living at or away from home in Greece. *Appetite*, *49*, 169-176.

Asghari, G., Yuzbashian, E., Mirmiran, P., Bahadoran, Z., & Azizi, F. (2016). Prediction of metabolic syndrome by a high intake of energy-dense nutrient-poor snacks in Iranian children and adolescents. *Pediatric Research*. *79*(5), 697–704.

Brandhorst, S., & Longo, V.D. (2019). Dietary Restrictions and Nutrition in the Prevention and Treatment of Cardiovascular Disease. *Circulation Research, 124*(6), 952-965. doi: 10.1161/CIRCRESAHA.118.313352.

Bruening, M., Brennhofer, S., van Woerden, I., Todd, M., & Laska., M. (2016). Factors related to the high rates of food insecurity among diverse, urban college freshmen. *Journal of the Academy of Nutrition and Dietetics*, *116*(9), 1450–1457.

Casey, P. H., Goolsby, S.L.P., Lensing, S.Y., Perloff, B.P., & Bogle, M.L. (1999). The use of telephone interview methodology to obtain 24-hour dietary recalls. *American Dietetic Association, 99*(11), 1406-11.

Chourdakis, M., Tzellos, T., Papazisis, G., Touli,s K., & Kouvelas, D. (2010). Eating habits, health attitudes and obesity indices among medical students in northern Greece. *Appetite*, *55*(3), 722-5

Conway, J. M., Ingwersen, L. A., & Mosfegh, A. J. (2004). Accuracy of dietary recall using the USDA five-step multiple-pass method in men: An observational validation study. *Journal of the American Dietetic Association*, *104*(4), 595-603. doi: 10.1016/j.jada.2004.01.007

Conway, J. M., Ingwersen, L. A., Vinyard, B. T., & Moshfegh, A. J. (2003). Effectiveness of the US Department of Agriculture 5-step multiple-pass method in assessing food intake in obese and nonobese women. *The American Journal of Clinical Nutrition*, *77*(5), 1171-8. doi: 10.1093/ajcn/77.5.1171. PMID: 12716668.

Deforche, B., Van Dyck, D., Deliens, T., & De Bourdeaudhuij, I. (2015). Changes in weight, physical activity, sedentary behaviour and dietary intake during the transition to higher education: A prospective study. *International Journal of Behavioral Nutrition and Physical Activity*, *12*(1), 16

Deliens, T., Van Crombruggen, R., Verbruggen, S., De Bourdeaudhuij, I., Deforche, B., & Clarys, P. (2016). Dietary interventions among university students: A systematic review. *Appetite*, *105*, 14-26.

Domosławska-Żylińska. K., Łopatek, M., Krysińska-Pisarek, M., & Sugay, L. (2023). Barriers to adherence to healthy diet and recommended physical activity perceived by the Polish population. *Journal of Clinical Medicine*, *13*(1), 22. doi: 10.3390/jcm13010022. PMID: 38202029; PMCID: PMC10779332.

Driskell, J. A., Kim, Y-N, & Goebel, K. J. (2005). Few differences found in the typical eating and physical activity habits of lower-level and upper-level university students. *Journal of the American Dietetic Association, 105*, 798-801.

Dyson, R., & Renk, K. (2006). Freshmen adaptation to university life: Depressive symptoms, stress, and coping. *Journal of Clinical Psychology*. *62*(10), 1231-1244.

El Ansari, W., Stock, C, & Mikolajczyk, R. T. (2012). Relationships between food consumption and living arrangements among university students in four European countries - a cross-sectional study. *Nutrition Journal*, *11,* 28.

Ezzati, M., & Riboli, E. (2013). Behavioral and dietary risk factors for noncommunicable diseases. *The New England Journal of Medicine*, *369*(10), 954–64.

Florence, M., Asbridge, M., & Veugelers, P. J. (2008). Diet quality and academic performance. *Journal of School Health*, *78*(4), 209–215.

Fung, T. T., Dam, R. M., Hankinson, S. E., Stampfer, M., Willett, W. C., & Hu, F. B. (2010). Low-carbohydrate diets and all-cause and cause-specific mortality: two cohort studies.

Annals of Internal Medicine, *153*(5), 289-98. doi: 10.7326/0003-4819-153-5-201009070-00003. PMID: 20820038; PMCID: PMC2989112.

Gan, W. Y., Nasir, M. T. M., Zalilah, M. S., & Hazizi, A. S. (2011). Differences in eating behaviours, dietary intake and body weight status between male and female Malaysian university students. *Malaysian Journal of Nutrition*, *17,* 213-228.

Hu, F. B., Stampfer, M. J., Manson, J. E., Rimm, E., Colditz, G. A., Rosner, B. A., Hennekens, C. H., & Willett, W. C. (1997). Dietary fat intake and the risk of coronary heart disease in women. *The New England Journal of Medicine, 337*(21), 1491-9. doi: 10.1056/NEJM199711203372102.

Institute for Public Health (2024). *National Health and Morbidity Survey (NHMS) 2023: Non-communicable Diseases and Healthcare Demand* - Key Findings. https://iku.nih.gov.my/images/nhms2023/key-findings-nhms-2023.pdf

Jaworowska, A., & Bazylak, G. (2007). Residental factors affecting nutrient intake and nutritional status of female pharmacy students in Bydgoszcz. *Roczniki Państwowego Zakładu Higieny*, *11*, 245–251.

Kolodinsky, J. & Horner, C. (2019). Childhood obesity, food choice, and market influence. In *Global perspectives on childhood obesity* (pp. 401-419). Academic Press

Lagiou, P., Sandin, S., Lof, M., Trichopoulos, D., Adami, H.O., and Weiderpass, E. (2012). Low carbohydrate-high protein diet and incidence of cardiovascular diseases in Swedish women: prospective cohort study. *BMJ*. *26*(344) doi: 10.1136/bmj.e4026. PMID: 22735105; PMCID: PMC3383863.

Lee, Y. Y., & Wan Muda, W. (2019). Dietary intakes and obesity of Malaysian adults. *Nutrition Research and Practice, 13*(2), 159–168. https://doi.org/10.4162/nrp.2019.13.2.159

Maugeri, A., Lio, R.M.S., Favara, G., La Rosa, M. C., La Mastra, C., Riela, P. M., … & Agodi, A. (2022). Impact of eating context on dietary choices of college students: Evidence from the HEALTHY-UNICT Project. *Nutrients*, *14*(20), 4418. doi.org/10.3390/nu14204418

McDonagh, J. E., Ambresin, A-E., Boisen, K. A., Fonseca, H., Kruse, P. J., Meynard, A., & Takeuchi, Y. (2018). The age of adolescence...and young adulthood. *The Lancet Child & Adolescent Health*. *2*(4), 19.

Mazier, M. J., & McLeod, S. L. (2007). University science students' knowledge of fats. *Canadian Journal of Dietetic Practice and Research*, *68*(3), 154–9.

Mikolajczyk, R. T., El Ansari. W., & Maxwell, A. E. (2009). Food consumption frequency and perceived stress and depressive symptoms among students in three European countries. *Nutrition Journal, 8*(31). https://doi.org/ 10.1186/1475-2891-8-31 PMID: 19604384 8.

Mithra, P., Unnikrishnan, B., Thapar, R., Kumar, N., Hegde, S., Mangaldas Kamat, A., … & Kumar, A. (2018). Snacking behaviour and its determinants among college-going students in coastal south India. Journal of Nutrition and Metabolism. doi: 10.1155/2018/6785741. PMID: 29850233; PMCID: PMC5932424.

Mueller, M. P., Blondin, S. A., Korn, A. R., Bakun, P. J., & Tucker, K. L., & Economos, C. D. (2018). Behavioral correlates of empirically-derived dietary patterns among university students. *Nutrients*, *10*, 716. doi: 10.3390/nu10060716.

Murray, C.J ., & Lopez, A. D. (2013). Measuring the global burden of disease. *The New England Journal of Medicine*, *369*(5), 448-57. doi: 10.1056/NEJMra1201534.

National Coordinating Committee on Food and Nutrition (NCCFN). (2017). *RNI Recommended Nutrient Intakes for Malaysia. A Report of the Technical Working Group on Nutritional*

Guidelines; Ministry of Health Malaysia, Putrajaya, Malaysia. ISBN 978-967-12050-4-4. http://nutrition.moh.gov.my/wp-content/uploads/2017/05/FABuku-RNI.pdf.

National Coordinating Committee on Food and Nutrition (NCCFN)(2021). *Malaysian Dietary Guidelines 2020*. National Coordinating Committee on Food and Nutrition, Ministry of Health Malaysia.

Ng, M., Fleming, T., Robinson, M., Thomson, B., Graetz, N., Margono, C., & Gakidou, E. (2014). Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet, 384(9945), 766-81. doi: 10.1016/S0140-6736(14)60460-8.

Niyaz, Q. C. (2020). Eating habits and gender differences among Turkish agricultural engineering students: a cross-sectional study. *Progress in Nutrition*, *22*(2), 568–576.

Nishida, C., Uauy, R., Kumanyik, S., & Shetty, P. (2004). The joint WHO/FAO expert consultation on diet, nutrition and the prevention of chronic diseases: Process, product and policy implications. *Public Health Nutrition*, *7*(1A), 245-50. doi: 10.1079/phn2003592. PMID: 14972063.

Papadaki, A., Hondros, G., & Scott, J., & Kapsokefalou, M. (2007). Eating habits of university students living at, or away from home in Greece. *Appetite*, *49*, 169-76.

Papier, K., Ahmed, F., Lee, P., & Wiseman, J. (2015). Stress and dietary behaviour among first-year university students in Australia: Sex difference. *Nutrition, 31*, 324-330.

Pesta, D. H., & Samuel, V. T. (2014). A high-protein diet for reducing body fat: mechanisms and possible caveats. *Nutrition & metabolism, 11*(1), 53. https://doi.org/10.1186/1743-7075-11-53

Rainville, B., & Brink, S. *Food insecurity in Canada, 1998-1999*. (2001) Catalogue No. MP32-29/01-2E-IN. Government of Canada Publications. http://publications.gc.ca/site/eng/home.html.

Roy, R., Rangan, A., Hebden, L., Louie, J.C.Y., Tang, L.M., Kay, J., & Farinelli, M.A. (2017). Dietary contribution of foods and beverages sold within a university campus and its effect on diet quality of young adults. *Nutrition*, *34*, 118-123.

Sanlier, N. & Unusan, N. (2007). The relationship betweennody weight and stress and nutritional status in Turkish women. *Pakistan Journal of Nutrition*, *6*, 339-344.

Shimbo, S., Zhang, Z.W., Matsuda-Inoguchi, N., Higashikawa, K., Nakatsuka, H., Watanabe, T., & Ikeda, M. (2004). Effects of Life away from home and physical exercise on nutrient intake and blood/serum parameters among girl students in Japan. *The Tohoku Journal of Experimental Medicine*, *203*. 275-286

Spanos, D. & Hanket, C.R. (2010). The habitual meal and snacking patterns of university students in two countries and their use of vending machines. *Journal of Human Nutrition and Dietetics*, *23*(1), 102-7.

Tao, X., Shao, Y., Xu, D., Huang, Y., Yu, X., Zhong T, … & Xiao, Y. (2022) Dietary Patterns and Nutrient Intake in University Students of Macao: A Cross-Sectional Study. *Nutrients*, *14*(17):3642. doi: 10.3390/nu14173642. PMID: 36079899; PMCID: PMC9460302.

Ukegbu, P., Nwofia, B., Ndudiri, U., Uwakwe, N., & Uwaegbute, A. (2019). Food insecurity and associated factors among university students. *Food and Nutrition Bulletin*, *40*(2), 271-281. doi:10.1177/0379572119826464

Vidal, E. J., Alvarez, D., Martinez-Velarde, D., Vidal-Damas, L., Yuncar-Rojas, K.A., Julca-Malca, A., & Bernabe-Ortiz, A. (2018) Perceived stress and high fat intake: A study in a sample of undergraduate students. *PLOS ONE*, *13*(3). https://doi.org/10.1371/journal.pone.0192827

World Health Organization (2003). *Diet, nutrition and the prevention of chronic diseases: Report of a joint WHO/ FAO expert consultation*. Geneva, Switzerland: WHO.

Worsley, A. (2002). Nutrition knowledge and food consumption: Can nutrition knowledge change food behaviour? *Asia Pacific Journal of Clinical Nutrition*, *11*, S579–85.

Yahia, N., Brown, C., Rapley, M., & Chung, M. (2014). Assessment of college students' awareness and knowledge about conditions relevant to metabolic syndrome. *Diabetology & Metabolic Syndrome*, *6*, 111. doi:10.1186/1758-5996-6-111.

Yahia, N., Brown, C.A., Rapley, M., & Chung, M. (2016). Level of nutrition knowledge and its association with fat consumption among college students. *BMC Public Health*, *16*, 1047. https://doi.org/10.1186/s12889-016-3728-z

Wilson, C. K., Matthews, J.I., Seabrook, J. A., & Dworatzek, P.D.N. (2017). Self- reported food skills of university students. *Appetite*, 108, 270-276.

Zellner, D. A., Loaiza, S., Gonzalez, Z., Pita, J., Morales, J., Pecora, D., & Wolf, A. (2006). Food selection changes under stress. *Physiology & Behavior*, *87*(4), 789–93. https://doi.org/10.1016/j.physbeh.2006.01.014 PMID: 16519909