

Determinant of Food Adequacy Level by Using Malaysian Food Variety Indicator (MFVI) among University Students from Low-Income Families in Serdang, Selangor

Shamsul Azahari Zainal Badari¹ & Muhammad Azim Arifin
Mohd Azilan²

¹Department of Resource Management and Consumer Studies, ²Department of Social and Development Sciences, Faculty of Human Ecology, Universiti Putra Malaysia, Serdang, Selangor

Email: shazri@upm.edu.my

To Link this Article: <http://dx.doi.org/10.6007/IJARBSS/v13-i16/18760>

DOI:10.6007/IJARBSS/v13-i16/18760

Published Date: 05-10-2023

Abstract

This research aims to identify the food adequacy level of students from low-income families at Universiti Putra Malaysia of Serdang campus. There were 250 students selected purposely for this study. The students must be living in-campus or off-campus and must be Malaysian. The Malaysian Food Variety Indicator (MFVI) was used to determine the food adequacy of respondents while Food Variety Score (FVS) was used to measure the food consumption pattern of respondents. The data were analyzed using SPSS software version 25. The results show that 52.8% of respondents were male and 47.2% were female students. 92.8% of respondents had a low category of FVS (0 to 90 scores), while 97.6% of respondents had a low level of MFVI. Pearson Correlation Test showed a significant relationship between FVS and MFVI ($r=0.593$, $p=0.000$). This proves that the level of food adequacy is affected by the food consumption pattern of respondents. It can be concluded that the low consumption of food will affect the food adequacy level of B40 students at Universiti Putra Malaysia. The management and related agencies can provide programs to ensure that these students had adequate food for them to safely undergo their studies at university.

Keywords: Food Adequacy, Food Consumption, Food Variety, University Students, Low-income

Introduction

Food is one of the most vital components in the world and it is really needed for the survival of humans besides shelter and clothing. These three items are considered human's basic needs in this modern era, and it is a measure of human survival and life well-being. Food

existence is the key to human well-being and the most important element in human life as it is a reason for a human to keep alive and a catalyst to one's health (De & Tulipa, 2019). Food inadequacy really led to many serious problems such as an increment in the crime rate in a country and affects one's health (Akerere, 2015). Food adequacy level is used to measure whether the food supply is enough for humans. Food adequacy is one of the components of the food security topic besides food availability and food access. Food adequacy level is a measurement to determine whether a person had enough food intake and whether a person eats enough food or not (Fawole, 2015).

Food adequacy has been widely spoken of as a vital and crucial issue at the national or international levels. Zahra & Renatha (2016) stated that food adequacy issues must not be seen as trivial or merely normal issues because the hunger issue has been spoken about for decades and from time to time and it involves human life in every single aspect such as quality of life and performance in working. It shows that food adequacy and hunger issues are serious problem that involves human basic needs besides water, air, and shelter. For ages, hunger issues and food inadequacy have been widely spoken such as in 2015 when United Nations released a statement about the global hunger issue where 690 million people are undernourished, and from 2019 to 2020, the number of undernourished people grew to 161 million which is absolutely a vast number, a crisis driven largely by climate change, conflict, war, and the COVID-19 pandemic. During the World War, food distribution in Turkey and Russia broke down rapidly, urging both countries to riot. This shows that food inadequacy issues are still spoken about through years and decades in various situations and places. Based on Sustainable Development Goals created by United Nations in 2015, zero hunger is one of the goals to be obtained for every country in this world. This is a good sign of serious awareness to eradicate food inadequacy issues worldwide and on a large scale (Diehl et. al, 2019). Everyone deserves enough food intake and a suitable adequate food level including students to enjoy and live a prosperous life (UNDP, 2015)

Access to an adequate food intake is an essential part of the right to an adequate living standard and life in human dignity, not only enough, but also enough, socially, and culturally acceptable, nutritious, and high-quality food must be readily available and long-term sustainable for everyone (Diehl et. al., 2019). According to the theory of hierarchical needs by Maslow, food is categorized as a physiological need that is classified considered utterly important for the human body to undergo homeostasis which is maintaining consistent levels in different bodily systems. If foods that are basic needs of humans are not met, the individual is considered in a 'dangerous state'.

Besides that, the rising of goods and services prices in a market causes the hike of food and rental price. This is the inflation affects student's daily life. Due to food prices increment, rental fees, and fuel prices are also affected. Students with financial problems have no other choice but to save money to survive on campus and it may affect their nutritional intake thus affecting their physical health prior to food consumption. This affects the food consumption pattern of university students when they need to save money due to expensive goods processes (Syamilah, 2022). If affected, it suggests that attending the academic performance and struggling to fully meet the demands of higher education (Uysal et. al., 2017). It should be noted that the example of an individual is a student, who tends to have the highest hierarchical needs to overcome all difficulties during the study year (Louise, 2015). Thus, the aim of this study is to measure the will measure food adequacy level of students from low-income families at Universiti Putra Malaysia by using the Malaysian Food Variety Indicator (MFVI) and Food Variety Scores (FVS).

Literature Review***Food Adequacy***

In other parts of this vast world, hunger issues are at a mediocre level. For example, in Latin America where food inadequacy is a catastrophic problem and continues to a high number such as in Brazil. According to the studies by Fafard St-Germain & Tarasuk in 2018, more than 5.2 million people went a day or more without eating, accounting for 2.5 percent of the world's hungry population of 821 million people in 2017. Although much progress has been made to reduce undernourishment such as including food and nutrition professionals to minimize these figures, the problem is still too big to handle. In Europe also, food inadequacy issues also have been a serious topic although many people may assume that Europe nations are developing but they also are facing the exact problems. 33.4 million Europeans were unable to afford a dinner containing meat, fish, or a vegetarian equivalent (Silvana, 2019). Each day, hundreds of millions of people face hunger issues (UNDP, 2015). An adequate level of food intake is utterly essential for students because it will determine their nutritional intake of the students itself. The recent economic recession and inflation may affect the adequacy level of food intake due to rising prices of groceries, which lead to rising meal prices in many places. Most traders will rise the prices of the goods in their stores to cope with the expensive groceries. To prevent and control diseases associated with globalization in developing nations, where people of high status or residing in urban areas often follow healthier diets, economic and social inequities as well as lifestyle risk behaviors in dietary patterns should be taken into consideration (Fawole, 2015).

It is crucial for people to consume appropriate meals that are sufficient in nutrients, and the best way to do so is to follow the dietary recommendations and eat a diversified diet that includes foods from all the major food groups (NCCFN, 2010). An adequate level of food can ensure the performance of people all day long. A study by Soldavini (2020) claimed that statistically, students with low food adequacy differed from those with high food adequacy in a variety of characteristics, including age, race/ethnicity, job status, and perceptions of their health.

Food Consumption

Data on food consumption estimates the amount of each prepared item ingested by persons. Due to differences in ethnicity, geographical location, age, and sex, food consumption data varies greatly from country to country and even within a country (Norimah et al., 2008). Estimating food consumption patterns is important because by examining the pattern, the data obtained could be used for a variety of objectives, including analyzing dietary patterns, determining nutrient intake sufficiency, measuring the intake and exposure of various pollutants and additives through food, and formulating policy in agriculture, food production, commerce, and health (Norimah et al., 2008).

In a certain amount of time, the pattern of B40 students' food intake or consumption can be surveyed through several ways such as 24-hour dietary recall, 3-day dietary record, food checklist, and FFQ. Based on a study by Thompson (2017), the most chosen method for determining food consumption patterns is the food frequency questionnaire (FFQ) because it is inexpensive, simple to administer, and needs little effort from the subjects. Individuals' frequency and quantity of food consumption can be estimated using FFQ by doing a checklist and recording what foods had been consumed. Food intake patterns can be used to determine the adequacy level of one's food intake in a certain amount of time and to compare

inter-day food consumption which is very assistive for people with a strict diet or people with health problems (Norimah et al., 2008).

Based on a report by Nutrition Department (2020), people should consume foods from the carbohydrate class such as rice (a staple food in Malaysia), bread, buns, etc. 3-5 servings per day as stated in the Malaysian Food Pyramid 2020. This is to ensure that humans get enough energy intake by getting an adequate intake of carbohydrates. More than one over third of college students worldwide were facing low-level food adequacy (Brescia, 2022). This can lead to other serious problems such as low performance in class. An adequate level of food intake is a serious concern regardless of the people's status. Gregory (2017) stated that 10 chronic diseases, including hypertension, cancer, stroke, diabetes, and kidney disease among other life-threatening illnesses, were substantially related to low and very low food adequacy levels. Compared to mothers with high food security, mothers with marginal food adequacy levels were three times more likely to report depression symptoms (Brescia, 2022). Another study by Whitaker (2006) stated that when certain demographic factors were considered, it was shown that anxiety or depression affected 21.0% of moms who were very slightly food secure, 16.9% of those who were very food secure, and 36.7% of those who were food insecure. These data imply that marginal food adequacy has a negative impact on both physical and mental health compared to a high level of food adequacy. This shows how adequate food intake is essential for humans.

Methodology

Study Location

This study was conducted in Universiti Putra Malaysia campus, Serdang, Selangor. This location was chosen because Universiti Putra Malaysia has around 20,000 students from various states, family statuses, and incomes which will provide more chances to collect data from students with low-income family backgrounds around the campus area regardless of residency.

Sampling

The sampling method used in this study was purposive sampling to gain the most accurate results based on the mentioned criteria. In this study, the number of respondents chosen was 250, and must be from a family household monthly income under RM 4850 based on classification by the Department of Statistics Malaysia in 2021. The inclusive criteria are local students staying in-campus or off-campus and must attend the class physically. The exclusion criteria are international students and those who do not attend class physically.

Study Instruments

The instrument that was used in this study was a questionnaire consisting of three parts. The first part was a background of respondents, developed to gain information regarding respondents' socio-demographic status such as age, gender, family income, and place of living. The second part of the questionnaire was Food Variety Score (FVS). The FVS was used to measure the food consumption pattern of respondents.

The food variety scores (FVS) approach was adapted and modified from Shamsul et. al. (2012). The scoring system was based on weekly intakes. The score was given 7 points for daily intake, 4 points for three to six times a week, 1 point for once a week, and 0 points for less than once a week. FVS is calculated by summing the total number of points for the 81 items of food, which is in the range of scores from 0 to 270 points. Only food items that were consumed by

the household in a week contributed to FVS. It means that if a food item is consumed less than once a week, it will not contribute any points to the scoring sum. Based on the scores given, it consists of 8 categories of foods with 84 items selected for inclusion in the calculation of FVS with scores ranging between 0 to 264 points. The FVS was then categorized based on tertiles with 33rd percentiles, 64th percentiles, and 100th percentiles.

The third part of the questionnaire was the Malaysian Food Variety Indicator (MFVI). The MFVI was used to determine the food adequacy level of respondents. MFVI was adapted From (Shamsul et al., 2018). There were eight groups of food in MFVI such as cereals and grains, fruits, vegetables, poultry/egg, meat, fish, legumes, and milk and dairy products. For each food group, the score was given based on a total score of 70 as shown in Table 1. Then, the score was divided based on the serving size taken daily with a minimum score was 0 and a highest score was 10, as shown in Table 2.

Table 1

Score Scheme for Malaysian Food Variety Indicator (MFVI)

Food Group	Score
Cereals and wheat	10
Fruits	10
Vegetables	10
Poultry	5
Meat	5
Fish and products	10
Legumes	10
Milk and dairy products	10
Total score	70

Notes: Range scores for cereals and wheat, fruits, vegetables, fish and products, legumes, and milk and dairy products groups: 0-10

Range scores for poultry and meat groups: 0-5

Table 2

Food Groups Score for Each Intake

Food Group	Serving/day	Max score	Serving/day	Median score	Serving/day	Min score
Cereals and grains	≥6	10	3-5	5	< 3	0
Fruits	≥2	10	1	5	< 1	0
Vegetables	≥3	10	1-2	5	< 2	0
Poultry and egg	≥0.5	5	0.25	2.5	< 0.25	0
Meat	≥0.5	5	0.25	2.5	< 0.25	0
Fish and products	≥1	10	0.5	5	< 0.5	0
Legumes	≥1	10	0.5	5	< 0.5	0
Dairy products	≥2	10	1	5	< 1	0

Data Collection and Data Analysis

The data was collected during the semester when students were around the campus. The respondents were asked to answer the questionnaire by themselves with the help

of the researcher. The respondents were asked to sign the consent form in agreement with their involvement in this study. The data were analysed as descriptive to examine the demographic and socio-economic distribution of the respondents. This analysis is assistive in defining respondents' profiles such as age, gender, monthly income and expenditure, and education level through frequency distribution and percentage. The Pearson Correlation test was used to measure whether the FVS has a relationship with the MFVI of respondents.

Results and Discussion

Demographic Background of Respondents

As shown in Table 3, there was a total of 250 respondents which consists of 132 males (52.8%) and 118 females (47.2%). Most of the respondents vary from age 23 to 27 (54.4%) of the overall surveyed respondents, followed by 18 to 22 years old (42.8 %) and 28 to 32 years old (2.8 %). Most of the respondent's ethnicity comes from Malay (84.8%) followed by Indigenous people (6.4 %), Indian (4.0 %), other (3.6 %), and Chinese (1.2%). In the religion section, most of the respondents are Muslim which was 224 people (89.6 %), followed by Hindu (2.8%) and then Buddha (1.2 %).

Table 3

Socio-Demographic Backgrounds of Respondents (N=250)

Variable	n (%)
Gender	
Male	132 (52.8)
Female	118 (47.2)
Age	
18-22	107 (42.8)
23-27	136 (54.4)
28-32	7 (2.8)
Ethnic	
Malay	212 (84.8)
Chinese	3 (1.2)
Indian	10 (4.0)
Indigenous people	16 (6.4)
Others	9 (3.6)
Religion	
Islam	224 (89.6)
Buddha	3 (1.2)
Hindu	7 (2.8)
Christian	13 (5.2)
Others	3 (1.2)
Residential	
In-campus	197 (72.8)
Off-campus	53 (21.2)
Year	
1	9 (3.6)
2	12 (4.8)
3	20 (8.0)

4	209 (83.6)
Income source	
PTPTN	93 (37.2)
JPA	51 (20.4)
Government Foundations	3 (1.2)
State Foundations	10(4.0)
Zakat Centres	17 (6.8)
Parents	47 (18.8)
Part-time works	14 (5.6)
Others	15 (6.0)

Food Variety Score (FVS) of Respondents

Food variety is recommended for all ages, especially in early adulthood or among young adults. A study showed that this age group tends to develop unhealthy dietary habits (Nelson et al., 2008). The main intention of using FVS is to measure the pattern of food variety intake and whether the respondents take various groups of food in a week (Shamsul et al., 2018). In this study, the FVS was used to identify the pattern of food consumed by respondents and analyzed using descriptive analysis to interpret the percentage of food consumed through a certain duration and recorded in Table 4. Based on the FVS, there are eight groups of food sorted from cereal and grains to fruits. The cereals and grains group had the highest intake (13.2 ± 9.2) followed by the vegetable group (12.2 ± 15.1).

The cereals and grains group had the highest intake due to the staple food of Malaysians was rice and the carbohydrate group being crucial in daily servings. Norhasmah et al., (2013) reported that in East Asia, one-third of the daily calorie intake was influenced by rice and followed by wheat. For meat and poultry, it was the source of protein that is also consumed along with carbohydrates. NCCFN in 2010 reported that fish, poultry, meat, and legumes (foods high in protein and saturated fat) should make up 10.0% to 15% of the daily caloric intake and need to be consumed in moderation. Two of the lowest food class variety score were legumes (0.1 ± 0.9) and followed by dairy products (1.8 ± 3.8). This study's result was not aligned with other studies. Bernardo et al., (2017) reported that most university students in Brazil and other foreign countries have unhealthy eating behaviors, such as a high intake of fast foods, snacks, sweets, soft drinks, and alcoholic beverages, and a low intake of fruits, vegetables, fish, whole grains, and legumes. The same results were also reported by Cheng & Khair (2020) that showed most of their respondent's had a low intake of vegetables and fruits.

Table 4

Mean and Standard Deviation of Food Variety Score (FVS)

Foods	Mean	Standard Deviation
Cereal and grains	13.2	9.2
Vegetables	12.2	15.1
Poultry and eggs	8.5	4.5
Fruits	6.0	16.4
Meat	4.1	7.02
Fish and products	2.9	6.1
Dairy products	1.8	3.8
Legumes	0.1	0.9

The FVS was then classified into three categories which are low, medium, and high. For the low category, the score ranges from 0 to 90. For the medium category, the score ranged from 91 to 180, and the score ranges for the high category were between 181 to 270 as stated in Table 5. The results showed that most of the respondents were in the low category of FVS (92.8%), while the rest was in the medium (4.8%) and high (2.4%) categories. This result was aligned with Tatiana et al (2017) that showed more than 75.25 % of the university students had low food variety. The same results were also reported by (Gan et al., 2011). The low FVS among respondents in this study showed that the diet of respondents was inadequate, and not enough variety. Variety was one of the principles of the Malaysian Dietary Guidelines (MDG) to get adequate nutrients from food (NCCFN, 2010). A study by Evans et al (2018) also showed low food variety among children in London and this result was estimated between 4 and 20% of children did not meet the recommended levels for individual micronutrients.

Table 5

Respondent's Food Variety Score-Category (N=250)

Category	Range Score	Frequency (n)	Percent (%)
Low	0-90	232	92.8
Medium	91-180	12	4.8
High	181-270	6	2.4

Food Adequacy Level of Respondents

The Malaysian Food Variety Indicator (MFVI) can be used as a tool to measure food variety and dietary diversity scores of the population and at the same time can be used to measure nutrient adequacy (Shamsul et al., 2018). The MFVI was developed by Shamsul et al (2018) and focuses more on the Malaysian population. In this study, the MFVI was used to measure the food adequacy level of respondents. The results were shown in Table 6. The highest total scores of MFVI were cereals and grains (35), followed by poultry and eggs (7.5), and meat (5). The mean of the MFVI for each food group is 2.1, 0.3, and 0.2 respectively. This can be indicated that in a day, the respondents often consume staple food such as rice, poultry, eggs, and meat as a daily meal. It seems that other food groups were not achieved the median scores as mentioned in Table 2. The other food groups have zero maximum scores MFVI, showing that students consumed less of these food groups in a day.

The adequacy of food can be related to nutrient adequacy and can be measured by dietary diversity scores. Most of the studies used guidelines and questionnaires to measure individual dietary diversity scores (IDDS) from nine food groups that were published by UN FAO (FAO, 2013). Ganpule-Rao et al (2021) used individual dietary diversity scores to measure the adequacy of nutrient intake among rural youth in India. Another study also used individual dietary diversity scores to measure micronutrient adequacy among rural farm households in western Kenya Fongar et al (2019), while a study by Akter et al (2021) used these tools to measure nutrient adequacy among adolescents in Bangladesh. In Malaysia, only a few studies had been done to measure nutrient adequacy by using dietary adequacy scores such as (Ramadas et al., 2021; Devindran et al., 2021; Shamsul et al., 2012). There were limited studies on food adequacy, and in Malaysia, it can be assumed that a few tools can be used to measure it such as MFVI Shamsul et al (2018) and Standardized Malaysian Healthy Eating Index (S-MHEI) (Jailani et al., 2021). Thus, in this study, the MFVI was used to measure food adequacy, and this can be a part of the reference on food adequacy intake among the Malaysian population.

Table 6

Total Scores of Food Groups Among Respondents Based on MFVI (N=250)

Food Groups	Maximum	Minimum	MFVI Mean
Cereals and grains	35	0	2.1
Poultry and eggs	7.5	0	0.3
Meat	5	0	0.2
Fish and products	0	0	0
Legumes	0	0	0
Dairy product	0	0	0
Vegetables	0	0	0
Fruits	0	0	0

The level of food adequacy of the respondents was shown in Table 7. Results show that 244 respondents (97.6%) had a low level of food adequacy with a score ranges 0 to 15. Only 3 respondents (1.2%) had medium food (16 to 30) and high food (31 to 45) adequacy level respectively. The low level of food adequacy among respondents may be due to the intake of foods that are not diverse and focus on specific foods only. Undiverse food intake can lead to insufficient nutrient needs. MFVI is very assistive in determining the intake of every food group in a day. Malaysian Dietary Guidelines (MDG) suggested that the people of Malaysia should eat a variety of meals. When a diet includes items from every category of the Malaysian Food Pyramid, it can be said to have "diversity" (NCCFN, 2010). However, the results of this study were not aligned with MDG.

Even though this study was not supported by MDG, other studies also have the same results. A study by Tatiana et al., (2017) reported that a majority of the students (95.25 %) had a low level of food variety, particularly in every food group such as (i) cereal and grains (96.75 %), (ii) meats and poultry (79.25 %), (iii) fish and seafood (91.50 %), (iv) milk and dairy products (93.25 %), (v) legumes (85.25 %), (vi) vegetables (75.25 %), and (vii) fruits (93.50 %). Other studies also reported the same results as this study (Bernardo et al., 2017; Cheng & Muhammad Khair, 2020).

Table 7

Food Adequacy Level of Respondents (N=250)

Level	Score total	Frequency	Percent (%)
Low	0-15	244	97.6
Medium	16-30	3	1.2
High	31-45	3	1.2

The Relationship Between Food Consumption and Food Adequacy of Respondents

The relationship between food consumption and food adequacy among respondents was shown in Table 8. In this table, food adequacy level (MFVI) and food consumption (FVS) were tested by using Pearson Correlation Test. The results show that there was a highly significant correlation between these two variables ($r=0.593$, $p=0.000$). This is because the limited variety of food consumed by respondents causes a low level of food adequacy. Furthermore, the results also showed that most of the respondents consumed high-energy foods such as cereals and grains, and at the same time consumed lots of fatty foods that come from poultry and eggs. This result was supported by previous studies such as Mekonnen et al (2021) that reported consumption of fatty foods was associated with nutrient adequacy, and cereals were

strongly associated with household nutrient adequacy, especially for rural households. A study by Angeles-Agdeppa et al (2020) also reported that poor diet quality is related to poor consumption of foods such as vegetables and fruits among Filipino adults. In a study conducted by Diehl et. al (2019) families with low preferences in food tend to have low food intake, causing the family to choose alternatives for the food and focus on specific types of food as staple daily food. People with lower food adequacy tend to have a lower dietary intake, which causes health problems. A study by Soldavini (2020) claimed that statistically, students with low food adequacy differed from those with high food adequacy in a variety of characteristics, including age, race or ethnicity, job status, and perceptions of their health.

Table 8

The Relationship of Food Consumption and Food Adequacy of Respondents (N=250)

		Food variety score
Food variety indicator	Pearson Correlation	0.593**
	Sig (2-tailed)	0.000
	N	250

Study Limitations

The main objective of the Malaysian Food Variety Indicator (MFVI) was to act as a tool to measure food variety and dietary diversity scores of the population and at the same time can be used to measure nutrient adequacy. To our knowledge, our study is the first one to use the MFVI as a tool to measure the food adequacy level of university students. Thus, this study has a few limitations. This study was conducted at the Universiti Putra Malaysia campus, which is in Serdang, Selangor. In terms of that, this study's results cannot be applied to students in another area outside of the Serdang campus area. In addition, the study conducted is limited only to 250 local students based on the sample number by Krejcie and Morgen table proposed by Bukhari (2021) as the number of students from low-income families in the year 2022 by the Academic Unit of Universiti Putra Malaysia has at least 947 students and round up to 950 to determine the number of respondents in this study. Furthermore, the food intake reported by the respondent depends on the honesty of the respondent due to the self-administered questionnaire. The biases and misreporting may be due to respondents' socio-economic status and social desirability concerns. The study's variable which only seeks the relationship between food consumption and food adequacy only can give the results on the food consumption patterns of the respondents but cannot be related to other factors that contributed to food adequacy.

Conclusion and Recommendation

The conclusion was derived from the results of the present study. The Food Variety Score (FVS) measured the respondents' food consumption patterns. Data on the food consumption pattern provides an estimation of the quantity of each food prepared and consumed by individuals in a certain amount of time (Norimah et al., 2008). Based on the study conducted, it can be concluded that foods high in energy (cereals and grains) have the highest intake indicating that it is the most consumed by the respondents, followed by the vegetables and, the poultry and eggs group. The Malaysian Food Variety Indicator (MFVI) was used to measure the level of food adequacy of the respondents. The food intakes of the respondents were based on the calculation of daily serving intakes of the foods for the purpose of determining indicators of food variety. However, even though vegetables were the second highest intake,

when we analyzed on food adequacy level, this food group was not adequate. Furthermore, the findings of this study clearly demonstrated that low levels of food adequacy were influenced by the respondents' own food consumption patterns due to the limited variety of food consumed. The respondents choose the most reliable diet of the day. Having access to suitable food adequacy is a basic human right and humans require food as much as other essential needs (Lewis, 2023).

It can be recommended that data from this study can be used by university administration to upgrade students' food adequacy levels. For example, by keeping affordable food menus in the cafeterias around campus. The relevant agencies and universities can give or apply for food assistance programs such as giving low-income students with food stamps to ensure the students can get enough food for their daily intake. Additionally, the data of this study can be used by relevant agencies to promote healthy and adequate food intake among university students in Malaysia. For further studies, the results can be improved by using students from intermediate and high incomes families to measure their food adequacy levels and do a comparison with this study. The tools used in the study can also be used to compare food diversity levels of different income levels in the population. Further studies on other factors that contribute to students' food consumption and food adequacy can be done such as food expenditure and socio-economic status of the students.

References

- Akerele, D. (2015). Household food expenditure patterns, food nutrient consumption and nutritional vulnerability in Nigeria: Implications for Policy. *Ecology of Food and Nutrition*, 54(5), pp 546–571. doi:10.1080/03670244.2015.1041136
- Akter, F., Hossain, M., Shamim, A., Khan, M., Hasan, M., Hanif, A., & Mridha, M. (2021). Prevalence and socio-economic determinants of inadequate dietary diversity among adolescent girls and boys in Bangladesh: Findings from a nationwide cross-sectional survey. *Journal of Nutritional Science*, 10, pp E103. doi:10.1017/jns.2021.89
- Angeles-Agdeppa, I., Sun, Y., & Tanda, K. V. (2020). Dietary pattern and nutrient intakes in association with non-communicable disease risk factors among Filipino adults: a cross-sectional study. *Nutrition Journal*, 19, (79). <https://doi.org/10.1186/s12937-020-00597-x>
- Bernardo, G. L., Jomori, M. M., Fernandes, A. C., & Proenca, R. P. C. (2017). *Rev. Nutri., Campinas*, 30(6), pp 847-865.
- Brescia, S. A., & Cuite, C. L. (2022). Underestimating college student food insecurity: Marginally food secure students may not be food secure. *Nutrients*, 14(15), pp 3142. doi: <https://doi.org/10.3390/nu14153142>
- Bukhari, S. A. (2021). *Sample size determination using Krejcie and Morgan table*. 10.13140/RG.2.2.11445.19687.
- Cheng, S-H., & Khair, M. K. (2020). Stress and food intake among university students - is there a relationship?. *Sains Malaysiana*, 49(1), pp 121-128. <http://dx.doi.org/10.17576/jsm-2020-4901-14>.
- De, L., & De, Tulipa. (2019). Healthy food for healthy life. *Journal of Global Biosciences*. 8 (9), pp 6453-6468. <https://www.mutagens.co.in/jgb/vol.08/09/Journal%20of%20Global%20Biosciences%20080904.pdf>
- Devindran, D., Ulaganathan, V., Oeh, Z. Y., Tan, L. X., Kuralneethi, S., Eng, E. Z. Y., Lim, L. S., Chien, G. W. N., Tay, J. L., & Lim, S. Y. (2022). Association between dietary diversity and weight status of aboriginal primary school children in Negeri Sembilan, Malaysia. *Malaysian Journal of Medical Science*, 29(1), pp 101–112. <https://doi.org/10.21315/mjms2022.29.1.10>
- Diehl, J., Oviatt, K., Chandra, A., & Kaur, H. (2019). Household food consumption patterns and food security among low-income migrant urban farmers in Delhi, Jakarta, and Quito. *Sustainability*, 11(5), pp 1378. <https://doi.org/10.3390/su11051378>
- Evans, C., Hutchinson, J., Christian, M. N., & Hancock, J. E. C. (2018). Measures of low food variety and poor dietary quality in a cross-sectional study of London school children. *European Journal of Clinical Nutrition*, 72, pp 1497–1505. <https://doi.org/10.1038/s41430-017-0070-1>
- St-Germain, F. A., & Tarasuk, V. (2018). Prioritization of the essentials in the spending patterns of Canadian households experiencing food insecurity. *Public Health Nutrition*, 21(11), pp 2065-2078. doi:10.1017/S1368980018000472
- Fawole, W. O., & Ilbasmis, E., & Ozkan, B. (2015). *Food insecurity in Africa in terms of causes, effects, and solutions: a case study of Nigeria*. [Paper presentation]. The 2nd International Conference on Sustainable Agriculture and Environment, Selcuk University and Bahri Dagdas International Agricultural Research Institute, Konya, Turkey.

- Fongar, A., Godecke, T., Aseta, A., & Qaim, M. (2019). How well do different dietary and nutrition assessment tools match? Insights from rural Kenya. *Public Health Nutrition*, 22(3), pp 391-403. doi:10.1017/S1368980018002756
- Food and Agricultural Organization of the United Nations. (2013). *Guidelines for measuring household and individual dietary diversity*. <http://www.fao.org/3/a-i1983e.pdf>
- Gan, W. Y., Mohd, N. 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(2), pp 213.
- Ganpule-Rao, A., Bhat, D., Yajnik, C., & Rush, E. (2021). Dietary diversity scores, nutrient intakes and biomarkers vitamin B12, folate and Hb in rural youth from the Pune Maternal Nutrition Study. *British Journal of Nutrition*, 126(2), pp 236-243. doi:10.1017/S0007114520004018
- Gregory, C. A., & Coleman-Jensen, A. (2017). Food insecurity, chronic disease, and health among working-age adults. *ERR-235*, U.S. Department of Agriculture, Economic Research Service.
- Jailani, M., Elias, S. M., & Rajikan, R. (2021). The new Standardized Malaysian Healthy Eating Index. *Nutrients*, 13(10), pp 3474. from <http://dx.doi.org/10.3390/nu13103474>
- Louise, V., Jacques, R., (2015) Food insecurity among students at the university of the Free State, South Africa. *South African Journal of Clinical Nutrition*, 28(4), pp160-169.
- Mekonnen, D. A., Trijsburg, L., Achterbosch, T. Brouwer, I. D., Kennedy, G., Linderhof, V., Ruben, R., & Talsma, E. F. (2021). Food consumption patterns, nutrient adequacy, and the food systems in Nigeria. *Agricultural and Food Economics*, 9(16). <https://doi.org/10.1186/s40100-021-00188-2>
- National Coordinating Committee on Food and Nutrition [NCCFN]. (2010). *Malaysian Dietary Guidelines*. (2nd Ed). Kuala Lumpur, Malaysia: Ministry of Health.
- Nelson, M. C., Story, M., Larson, N. I., Neumark-Sztainer, D., & Lytle, L. A. (2008). Emerging adulthood and college-aged youth: an overlooked age for weight-related behavior change. *Obesity*, 16(10), pp 2205-2211.
- Norhasmah, S., Zuroni, M. J., & Marhana, A. B. (2013). Food insecurity among public university students receiving financial assistance in Peninsular Malaysia. *Malaysian Journal of Consumer and Family Economics*, 16, pp 78–91.
- Nutrition Department. (2020). *Malaysian Food Pyramid 2020: Guide to your daily food intake*. Ministry of Health, Malaysia. <https://www.moh.gov.my/nutritionwp-content/uploads/2021/10/Piramid-Makanan-Malaysia-2020-BI.pdf>
- Ramadas, A., Tham, S. M., Lalani, S. A., & Shyam, S. (2021). Diet quality of Malaysians across lifespan: A scoping review of evidence in a multi-ethnic population. *Nutrients*, 13(4), pp 1380. doi: 10.3390/nu13041380. PMID: 33924050; PMCID: PMC8074191.
- Shamsul, A. Z. B., Jayashree, A., Sharifah A. H., Laily, P., Norhasmah, S., & Masud, J. (2012). Food variety and dietary diversity scores to understand the food-intake pattern among selected Malaysian households. *Ecology of Food and Nutrition*, 51(4), pp 265-299, DOI: 10.1080/03670244.2012.674445
- Shamsul, A. Z. B., Abdul Rahman, M., Norhasmah, S., Ahmad, H., & Syuhaily, O. (2018). The development of Malaysian food variety indicator (MFVI) among low-income households in Malaysia: A Pilot Study. *Jurnal Penggunaan Malaysia*, 31, pp 57-69.
- Silvana, D. P. (2019). Hunger in Latin America: What can we do? *Prehospital Disaster Medicine*, 34 (Suppl. 1), S94 <https://doi.org/10.1017/S1049023X19001948>

- Soldavini, J., & Berner, M. (2020). The importance of precision: Differences in characteristics associated with levels of food security among college students. *Public Health Nutrition*, 23(9), pp 1473–1483. <https://doi.org/10.1017/s1368980019004026>
- Syamilah, F. (2022). when all the goods go up in prices. *Sinar Harian* <https://www.sinarharian.com.my/article/202775/SUARA-SINAR/Analisis-Sinar/Apabila-semua-barang-naik-harga>
- Tatiana, S., Norhasmah, S., & Syuhaily, O. (2017). Food variety and its contributing factors among public university students in Klang Valley. *Malaysian Journal of Consumer and Family Economics*, 20, pp 16-34.
- Thompson, F. E., & Subar, A. F. (2017). Dietary assessment methodology. *Nutrition in the Prevention and Treatment of Disease*, pp 5–48. <https://doi.org/10.1016/b978-0-12-802928-2.00001-1>
- United Nations Development Programme. (2015). *Sustainable development goals*. Department of Economic and Social Affairs. <https://sdgs.un.org/goals>.
- Uysal, H., Tezcan, Aydemir, S., & Genç, E. (2017). Maslow's hierarchy of needs in 21st century: The examination of vocational differences. In Arapgirlioğlu, H., Elliot, R. L., Turgeon, E., & Atik, A. (Eds.), *Research on science and art in 21st century*, (pp 211-227). Gece Kitaplığı.
- Whitaker, R. C., Phillips, S. M., & Orzol, S. M. (2006) Food insecurity and the risks of depression and anxiety in mothers and behavior problems in their preschool-aged children. *Pediatrics* 118, 859–868.
- Zahra, M., & Renatha, P. (2016). Nutrient adequacy of foods consumed among adult population residing in urban parts of Dar-es-salaam, Tanzania. *International Journal of Innovative Research and Development*, 6, 10.24940/ijird/2017/v6/i12/DEC17001.