

**THE ASSOCIATION OF FOOD INSECURITY STATUS WITH
PHYSICAL ACTIVITY LEVELS AND DIETARY PRACTICES OF
STUDENTS IN HEALTH CAMPUS, UNIVERSITI SAINS
MALAYSIA**

**NURUL NURHIDAYAH BALKHIS BINTI MOHD
SANUSI**

**SCHOOL OF HEALTH SCIENCES
UNIVERSITI SAINS MALAYSIA**

2025

**THE ASSOCIATION OF FOOD INSECURITY STATUS WITH
PHYSICAL ACTIVITY LEVELS AND DIETARY PRACTICES OF
STUDENTS IN HEALTH CAMPUS, UNIVERSITI SAINS
MALAYSIA**

by

NURUL NURHIDAYAH BALKHIS BINTI MOHD SANUSI

Thesis submitted in fulfilment of the requirements

for the degree of

Bachelor of Health Sciences (Honours) (Dietetics)

JULY 2025

i

DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated and duly acknowledged. I also declare that it has not been previously or concurrently submitted as a whole for any other degree at Universiti Sains Malaysia or any other institution. I grant Universiti Sains Malaysia the right to use the dissertation for teaching, research, and promotional purposes.



.....

Nurul Nurhidayah Balkhis Binti Mohd Sanusi

Date: 2 JULY 2025

ACKNOWLEDGEMENT

I would like to express my gratitude to Allah SWT for providing me with the opportunity and for assisting me in completing this dissertation. I am deeply grateful to my supervisor, Dr Nur Nadia Binti Mohamed, for the advice, guidance, and encouragement during my entire research process and thesis writing.

I would like to thank the participants who were involved in my research and provided their cooperation to help me complete this study. I am also thankful to the dietetic lab assistant for helping me borrow the equipment and use the lab for assessment.

I am deeply indebted to my parents, Siti Hariza binti Mohd Yusuf and Mohd Sanusi bin Sahak, for their support and encouragement to me throughout my studies.

PERKAITAN DI ANTARA STATUS KETIDAKJAMINAN MAKANAN DENGAN TAHAP FIZIKAL AKTIVITI DAN AMALAN PEMAKANAN DDI KALANGAN PELAJAR DALAM KAMPUS KESIHATAN, UNIVERSITI SAINS MALAYSIA

ABSTRAK

Isu berkaitan status tahap ketidakjaminan terhadap makanan dalam kalangan pelajar universiti semakin membimbangkan. Kajian ini bertujuan untuk mengetahui perkaitan antara status tahap ketidakjaminan terhadap makanan dengan tahap fizikal aktiviti dan amalan permakanan pelajar, dalam kalangan pelajar di Kampus Kesihatan, Universiti Sains Malaysia. Kajian keratan rentas ini, melibatkan 263 pelajar di Kampus Kesihatan, dipilih menggunakan persampelan mudah. Status tahap ketidakjaminan terhadap makanan dinilai menggunakan Skala Pengalaman Ketidakjaminan Makanan Malaysia (MFIES), dan ‘International Physical Activity Questionnaire’ (IPAQ), digunakan untuk mengukur tahap aktiviti fizikal. Soal selidik Amalan permakanan diambil dari ‘National Health and Morbidity Survey 2019’ (NHMS 2019) digunakan untuk menilai amalan pemakanan. Keputusan menunjukkan bahawa 74.6% pelajar sarjana muda Kampus Kesihatan USM menghadapi masalah ketidakjaminan terhadap makanan. Ia dikategorikan sebagai 49.8% menghadapi tahap ketidakjaminan terhadap makanan ringan, 22.1% menghadapi tahap ketidakjaminan terhadap makanan sederhana, dan 2.7% menghadapi tahap ketidakjaminan terhadap makanan yang teruk. Status tahap ketidakjaminan terhadap makanan mempunyai perkaitan dengan punca elaun utama apabila pelajar yang menerima pinjaman mempunyai keputusan lebih tinggi dalam ketidakjaminan makanan ($p=0.029$). Walau bagaimanapun, status tahap ketidakjaminan terhadap makanan tidak terdapat perkaitan antara tahap aktiviti fizikal dan amalan pemakanan ($p>0.05$). Kesimpulannya, pelajar yang menghadapi masalah ketidakjaminan

makanan mempunyai tahap fizikal aktiviti yang sederhana dan cara pemakanan mereka tidak terjejas. Bagi kajian pada masa hadapan boleh melakukan kajian lanjut terhadap kesan jangka masa panjang bagi status tahap ketidakjaminan makanan dalam kalangan pelajar di university.

THE ASSOCIATION OF FOOD INSECURITY STATUS WITH PHYSICAL ACTIVITY LEVELS AND DIETARY PRACTICES OF STUDENTS IN HEALTH CAMPUS, UNIVERSITI SAINS MALAYSIA

ABSTRACT

The issue of food insecurity among university students is becoming an increasing concern. This study aimed to investigate the relationship between food insecurity status and physical activity levels, as well as dietary practices, among students at the Health Campus of Universiti Sains Malaysia. This cross-sectional study, involving 263 students at the Health Campus, was selected using convenience sampling. Food insecurity status was assessed using the Malaysian Food Insecurity Experience Scale (MFIES), and the International Physical Activity Questionnaire (IPAQ) was used to measure physical activity levels. The dietary practices questionnaire, taken from the 2019 National Health and Mobility Survey, was used to assess dietary practices. The results indicated that 74.6% of undergraduate students at USM Health Campus faced food insecurity. It was categorized as 49.8% faced mild food insecurity, 22.1% faced moderate food insecurity, and 2.7% faced severe food insecurity. Food insecurity is associated with the primary source of allowances, as students who received loans reported higher levels of food insecurity ($p = 0.029$). However, there is no association between food insecurity and physical activity levels and dietary practices ($p > 0.05$). In conclusion, food-insecure students exhibit moderate physical activity levels, and their dietary practices remain unaffected. Future research can conduct further research on the long-term effects of food insecurity status among university students.

TABLE OF CONTENTS

Certificate	ii
DECLARATION	iii
ACKNOWLEDGEMENT	iv
ABSTRAK	v
ABSTRACT	vii
LIST OF TABLES	x
LIST OF FIGURES	xi
LIST OF ABBREVIATIONS	xii
CHAPTER 1 INTRODUCTION	1
1.1 Background of the study	1
1.2 Problem Statement	3
1.3 Study rationale	4
1.4 Research objectives.....	4
Specific objective:	4
1.5 Research hypothesis.....	5
1.6 Conceptual framework.....	6
CHAPTER 2 LITERATURE REVIEW	7
2.1 Food Insecure	7
2.2 Physical activity levels.....	10
2.3 Dietary practices	11
2.4 Association of food insecurity status with physical activity levels	13
2.5 Association of food insecurity status with dietary practices.....	14
CHAPTER 3 METHODOLOGY	15
3.1 Research design.....	15
3.2 Study Area.....	15
3.3 Study population	15
3.4 Selection criteria	16
3.5 Sampling method	16
3.6 Sample size estimation.....	17
3.7 Research tool.....	18
3.8 Data collection method	23
3.9 Data analysis	24
CHAPTER 4 RESULT	25
4.1 Characteristics of the participants	25
4.2 Anthropometric measurement of the participants.....	27

4.3	Physical activity levels of the participants	27
4.4	Dietary practices of the participants.....	28
4.5	The levels of food insecurity status among university students.....	30
4.6	Characteristics of the participants by food insecurity status	31
4.7	Association between BMI and food insecurity status	33
4.8	Association between physical activity levels and food insecurity status	34
4.9	Association between dietary practices and food insecurity status	35
	CHAPTER 5 DISCUSSION	37
5.1	Prevalence of food insecurity among University students.....	37
5.2	Characteristics of the participants by food insecurity status.....	38
5.3	Association between physical activity levels and food insecurity status.....	40
5.4	Association between dietary practices and food insecurity status	42
5.5	Limitations and strengths	44
	CHAPTER 6.....	45
	CONCLUSION.....	45
	REFERENCES.....	46
	Appendix A.....	52
	Appendix B	53
	Appendix C.....	54
	Appendix D.....	57
	Appendix E	60

LIST OF TABLES

Table 3.1: Level of food insecurity (Jones, 2017)	19
Table 3.2 Formula used for calculating the level of physical activity	20
Table 4.1 Characteristics of the participants (n=263).....	26
Table 4.2 Anthropometric measurements of the participants (n=263)	27
Table 4.3 Physical activity level of the participants (n=263)	27
Table 4.4 Dietary practices of students in Health Campus, USM (n=263)	29
Table 4.5 Level of food insecurity among university students (n=263).....	30
Table 4.6 Characteristics of the participants by food insecurity status (n=263).....	32
Table 4.7 Association between BMI and food insecurity status (n=263).....	33
Table 4.8 Association between physical activity level and food insecurity status (n=263).....	34
Table 4.9 Association between dietary practices and food insecurity status.....	36

LIST OF FIGURES

Figure 1.1: Conceptual framework of the association between food insecurity status with physical activity levels and dietary practices.....	6
Figure 3.1: The calculation for specific objective 2 and specific objective 3 was carried out by using GPower software.....	18

LIST OF ABBREVIATIONS

USM: Universiti Sains Malaysia

MFIES: Malaysian Food Insecurity Experience Scale

IPAQ: International Physical Activity Questionnaire

NHMS: National Health and Morbidity Survey 2019

BMI: Body Mass Index

WHO: World Health Organization

CHAPTER 1

INTRODUCTION

1.1 Background of the study

Food insecurity refers to the ‘inability to get sufficient food and nutrition’ (Ramlee *et al.*, 2019). According to the Food and Agriculture Organization of the United Nations (2024), food insecurity occurs when people lack access to adequate, safe, and nutritious food necessary for normal growth and development, as well as an active and healthy lifestyle (Food and Agriculture Organization of the United Nations, 2024).

Numerous studies have shown that university students experienced food insecurity (Faidi *et al.*, 2023; Ramlee *et al.*, 2019; Ukegbu *et al.*, 2019). Those who experienced food insecurity were more likely to be from low-income families and receive financial aid (Ahmad *et al.*, 2021). Prior research shown, they need to spend money to buy food after paying for university and accommodation fees (Nisha *et al.*, 2017). Students mostly get allowances from loans such as ‘Perbadanan Tabung Pendidikan Tinggi Nasional’ (PTPTN) (Ramlee *et al.*, 2019). Students who food insecurity were also higher among aged between 19 to 26 years old (Rajikan *et al.*, 2019), female, single, and Malay (Ramlee *et al.*, 2019).

Previous studies have shown that food insecurity can influence physical activity levels (Gough *et al.*, 2024). It has been suggested that students experiencing food insecurity may be less energetic when engaging in daily physical activity (Shii *et al.*, 2015). Existing studies also showed that people who experienced food insecurity tend to decrease their physical activity levels in order to minimize their energy expenditure (Lee and Cardel, 2019).

Food insecurity is a growing concern among university students, as it can impact their dietary habits. Previous research has shown that students know the importance of a balanced diet, but they often skip meals such as breakfast (Chen Yun *et al.*, 2018). They also tend to consume high-calorie foods such as fried food and snacks (Eng *et al.*, 2022). The limitation of healthy food in university cafeterias and expensive prices cause students to prefer unhealthy food, which is cheaper and affordable (Sulaiman *et al.*, 2021). Poor dietary practices can increase the risk of obesity or overweight among university students (El Zein *et al.*, 2020).

This condition illustrates how food insecurity affects physical activity levels and dietary habits. Thus, this study will investigate the association between food insecurity status, physical activity levels, and dietary practices among students in Health Campus, Universiti Sains Malaysia.

1.2 Problem Statement

The issue of food insecurity among university students is becoming an increasing concern. They might prioritize spending their money on tuition fees, hostel or house rent, and textbooks over food (Rajikan *et al.*, 2019). As a result, they might reduce the amount and quality of their food intake. They also possibly choose cheaper food (Eng *et al.*, 2022). These students prefer to buy high-calorie food rather than fruit and vegetables to increase their satiety and make it more affordable (Martinez *et al.*, 2019). When students frequently consume unhealthy food at risk of becoming overweight or obese (El Zein *et al.*, 2020). In addition, they were more likely to develop chronic diseases such as diabetes mellitus, hypertension, and cardiovascular disease in the future (El Zein *et al.*, 2020). Therefore, there is a need to investigate whether a relationship exists between the food insecurity status of university students and their dietary practices.

In addition, food security may influence chronic disease due to the changes in the physical activity levels and dietary practices of university students (To *et al.*, 2014). Individuals who experience food insecurity are possibly less energetic and less likely to be involved in physical activity (Lee and Cardel, 2018; Gough *et al.*, 2024). However, the investigation of the association between the physical activity levels of university students and their food insecurity status still limited.

1.3 Study rationale

This study investigates the association between the food insecurity status of university students with physical activity levels and dietary practices. The findings of this study can help researchers and healthcare practitioners develop suitable intervention programmes for university students who experience food insecurity and improve their physical activity levels and dietary practices.

1.4 Research objectives

General objective:

To investigate the association between food insecurity status with physical activity levels and dietary practices of university students.

Specific objective:

1. To determine the prevalence of university students who experienced food insecurity.
2. To determine the associations between food insecurity and the physical activity level of university students.
3. To determine the association between food insecurity and dietary practices of university students.

1.5 Research hypothesis

H₀: There is no association between food insecurity status and physical activity levels of university students.

H_a: There is an association between food insecurity status and the physical activity level of university students.

H₀: There is no association between food insecurity status and dietary practices of university students.

H_a: There is an association between food insecurity status and dietary practices of university students.

1.6 Conceptual framework

The socio-demographic factors like age, ethnicity, marital status, total household income, and source of allowance influence food insecurity status. Food insecurity status will influence both physical activity levels (Lee & Cardel, 2018; Gough *et al.*, 2024) and dietary practices (Eng *et al.*, 2022; Mohd Jamil *et al.*, 2020). Then, food insecurity status can cause low physical activity level and poor dietary practices (Shii *et al.*, 2015), leading to overweight or obesity.

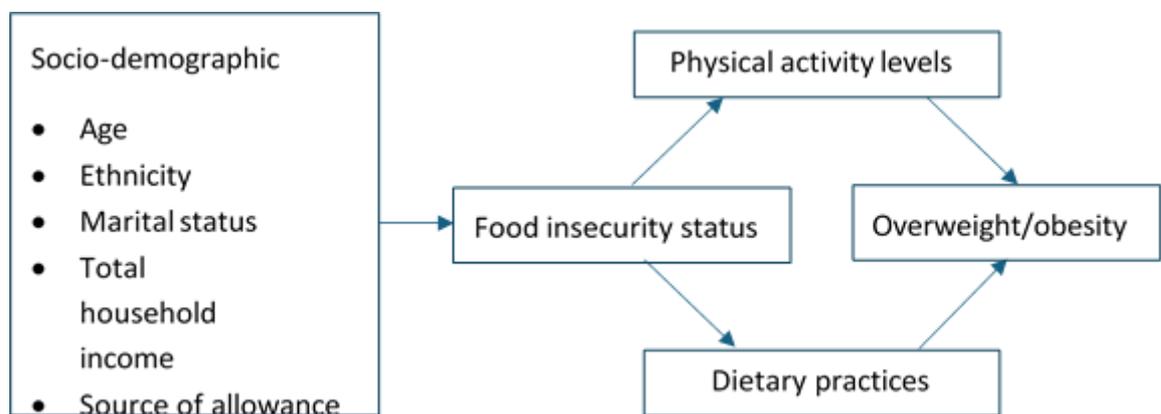


Figure 1.1: Conceptual framework of the association between food insecurity status with physical activity levels and dietary practices.

CHAPTER 2

LITERATURE REVIEW

2.1 Food Insecure

2.1.1 Definition

According to the Food and Agriculture Organization of the United Nations (2024), food insecurity occurs when people lack access to adequate, safe, and nutritious food necessary for normal growth and development, as well as an active and healthy lifestyle. Food insecurity is defined as inadequate access to physical or economic safety, nutritious, and sufficient food (Foini *et al.*, 2023). According to research conducted by Azmi *et al.* (2022), food insecurity refers to the inability to access healthier, nutritious food that is socially acceptable, which is a significant public health concern.

2.1.2 Assessment of food insecurity

Food insecurity among US college students was analyzed using a 10-item Validated Adult Food Insecurity Survey (AFSS) (El Zein *et al.*, 2020). The respondents will be categorized as having high food secure refers to not having a problem getting food, marginal food security refers to feeling anxious about the food supply, low food security refers to a decrease in the amount of quality and food, and very low insecurity refers to “food insecure with hunger” (El Zein *et al.*, 2020). Then, in a local study by Nur & Nourfarizan-Hanoon N.A (2024) used the U.S. Adult Food Security Survey Model (AFSSM) will consist of 4 categories for insecurity such as 0 score for high food security, 1-2

for marginal food security, 3-5 low food security and 6-10 very low food security. Next, for the studies among university students at Selangor (Rajikan *et al.*, 2019) and Pahang (Mohd Abu Bakar *et al.*, 2019) used the USDA Six-item Short Form of Survey Module (USDAFSSM) questionnaire to assess university students who experienced food insecurity. The USDAFSSM questionnaire categorized food insecurity by referring to a scoring system between 0 and 10 based on the points respondents answered (Engel *et al.*, 2022). Food insecurity will be categorized as high food secure with a score of 0, marginal food secure with a score 1-2, low food secure with a score 3-5, and very low food secure with a score of 6-10 (Engel *et al.*, 2022).

2.1.3 The prevalence of food insecurity

Food insecurity is a significant concern among university students worldwide. In the US, college students have reported that the prevalence of students experiencing food insecurity ranges from 19.0% to 43.1% (El Zein *et al.*, 2020). In Malaysia, a recent study by Nur and Nourfarizan-Hanoon N.A (2024) found that the prevalence of food insecurity among undergraduate students at Universiti Sains Malaysia was 44.8%. A study by Mohd Abu Bakar *et al.* (2019) conducted among university students in Pahang reported a prevalence of food insecurity of 55.4%. Then, a study conducted among university students in Selangor stated that 69.4% of students were categorized as food insecure. So, it shown high values among university students faced food insecurity.

2.1.4 Factors that are associated with food insecurity

Many factors influence food insecurity. One of the factors includes age. Based on previous studies, students ranging from 19 to 26 years old (Rajikan *et al.*, 2019) and 21 to 25 years old (Ukegbu *et al.*, 2019) faced food insecurity. Secondly, the factor is gender; Malay students are mostly high in food insecurity (Ramlee *et al.*, 2019) then continue with Indian and Chinese students (Rajikan *et al.*, 2019). Then, students who face food insecurity 95.7% consist of non-married students (Ukegbu *et al.*, 2019), and Ramlee *et al.* (2019) also mainly stated that single students responded to this. Total household income also influences food insecurity in students. Regarding Mohd Jamil *et al.* (2020) the percentage of food insecurity is higher in students who have lower income or B40 families but there is no association between food insecurity and household income. However, financial problems among students can be a factor due to students do not having primary income. Typically, students' allowances usually come from loans, scholarships, and parental support (Mohd Jamil *et al.*, 2020).

2.2 Physical activity levels

2.2.1 Definition and assessment of physical activity levels

Physical activity refers to ‘physical activity as any bodily movement produced by skeletal muscles that requires energy expenditure’ (World Health Organization,2024). It includes all forms of movement, including leisure time, work, and household tasks. For example, walking, biking, cycling, sports, active recreation, and play are all physical activities that can be engaged in at any level (World Health Organization, 2024).

Physical activity levels will be assessed using the Short-form IPAQ. The short form of IPAQ assesses walking, sitting, moderate, and vigorous activity. The IPAQ short-form is a self-reported questionnaire that leads students to easily answer it. IPAQ questionnaire has ICC 0.71 until 0.89 of reliability and r 0.15 until 0.26 for moderate validity, which it widely use among university students (Peng *et al.*, 2025). A pedometer is used to measure the step count in. Pedometer will estimate the general physical activity levels by recounting the steps per days. Pedometer do not capture the non-ambulatory activities like cycling but give the information for activity involving the steps count (Peng *et al.*, 2025). For this study pedometer did not used but other study have used it.

2.2.2 Prevalence of physical activity levels

Maintaining physical activity levels is essential for university students to meet the recommended physical activity guidelines. Yusuf *et al.* (2023) documented a systematic review that found that only 22% of Malaysian university students meet their physical activity requirements. Prolonged academic stress, limited time, and restricted access to facilities are considered factors that contribute to low physical activity levels (Nor *et al.*, 2023). Furthermore, the COVID-19 pandemic has contributed to the challenges of increasing sedentary behavior among students (Chong *et al.*, 2024)

2.3 Dietary practices

2.3.1 Definition and assessment of dietary practices

Dietary practices refer to ‘observable action or behavior of dietary habit’(Mulat Tirfie Bayih *et al.*, 2024). It refers to the quantities, variety, and frequency of consuming various foods and beverages in their diet (Mulat Tirfie Bayih *et al.*, 2024). According to the study by Eng *et al.* (2022), the questionnaire used to assess dietary practices among Malaysian adults is from Malaysia’s National Health and Morbidity surveys. Based on a previous study conducted among college students using the Dietary Screener Questionnaire, which the US National Cancer Institute developed to assess dietary practices (Shi *et al.*, 2021). These tools have been validated among the adult population and in clinical settings; however, their validation specifically for university students is not yet exact (Shi *et al.*, 2021).

2.3.2 Prevalence of dietary practices

The prevalence of dietary practices among Malaysian adults shows that 89.5% of B40 adults do not achieve adequate vegetable and fruit consumption (Eng *et al.*, 2022).for adult consumed sugar sweetened beverages,ready to drinks beverages, sugar-added self prepared drinks and premix drinks at least one per week is 68.1% reported (Eng *et al.*, 2022). The study conducted at university students state that students have lowers intake of health food such as fruits and vegetables (Shi *et al.*, 2021). In addition, more students have highers intake of unhealthy food as their meal such added sugar, fast food and sugar sweetened beverages (Shi *et al.*, 2021). According to the previous study among adults in United States indicate that some adults have increasing of consumption of sweet and have decreased of consuming of fruits, vegetables and nutritious food (Bin Zarah *et al.*, 2020).

2.3.3 Factor associated with dietary practices

Dietary practices among university students will be influenced by several factors, including socioeconomic status, culture, and knowledge of food types. Due to limited time and a lack of cooking skills, research shows many students will choose convenient food even if it is unhealthy (Mohd Jamil *et al.*, 2020). Food insecurity among students makes them choose cheaper food, high- energy food, and a lack of essential nutrients (Eng *et al.*, 2022; Mohd Jamil *et al.*, 2020). Study found that university students will purchase food at an affordable price than nutritional value (Sanusi, 2020).

2.4 Association of food insecurity status with physical activity levels

The relationship between food insecurity and physical activity levels has been highlighted in recent studies. According to research conducted in Malaysia by Mohammed *et al.* (2022), approximately 62% of university students experienced food insecurity, which significantly has lower physical activity levels. The studies reported that food-insecure students are more likely to have sedentary behaviors due to financial problems that limit their ability to be active in university (Lee and Cardel, 2018; Gough *et al.*, 2024). Furthermore, a lack of access to healthy food can lead to decreased energy levels.

2.5 Association of food insecurity status with dietary practices

Food insecurity will influence dietary behavior due to poor diet consumption. Research indicates that food insecurity is linked to higher calorie consumption and poorer nutritional choices resulting from financial difficulties (Ramlee *et al.*, 2019). Students who have food insecurity will skip meals and will increase deficiencies of minerals and vitamins in their daily intake (Nur & Nourfarizan-Hanoon N.A, 2024). Research done by Lee *et al.* (2022) found university students who face food insecurity have lower consumption of fruits and vegetables compared to food-secure students. Long-term consumption of poor dietary practices can result in malnourishment and other diseases. Then, the studies showed that 62.8% of university students who are reported as having food insecurity have consumed processed food higher than fresh food (Mohd Jamil *et al.*, 2020).

Food insecurity can influence students to become obese or overweight due to poor dietary practices. It is because unhealthy food contains high fat, oil, and calories. Food insecure students will choose food that can make them feel better satiety than healthy food due to the price cheaper than healthy food (Chen Yun *et al.*, 2018; Eng *et al.*, 2022). Consuming unhealthy food in the long term puts the person at high risk of chronic diseases such as hypertension, diabetes mellitus, and cardiovascular diseases (El Zein *et al.*, 2020). Studies have shown that students with poor dietary practices will become less energetic and not physically active (Shii *et al.*, 2015). They do not want to spend more energy expenditure.

CHAPTER 3

METHODOLOGY

3.1 Research design

A cross-sectional study design was conducted among participants of undergraduate students in the Health Campus, Universiti Sains Malaysia. The cross-sectional study design was used to determine the association of food insecurity status with physical activity levels and dietary practices.

3.2 Study Area

This study was conducted in the Health Campus, Universiti Sains Malaysia (USM). This campus is located in Kelantan, which is the north-eastern corner of Peninsular Malaysia.

3.3 Study population

This study involved all the students from three schools in USM, which were the School of Health Sciences (PPSK), the School of Medical Sciences (PPSP), and the School of Dental Sciences (PPSG).

3.4 Selection criteria

The inclusion and exclusion criteria of the participants were described below:

a. Inclusion criteria

- I. Aged 18-years-old and above
- II. Males and females
- III. Undergraduate students
- IV. Students were able to understand and communicate in Malay

b. Exclusion criteria

- I. International students were excluded
- II. Students with physical disabilities
Pregnant

3.5 Sampling method

The population for this study included all undergraduate students in Health Campus, USM. The sampling method used in this study was convenience sampling which was non-probability sampling for recruited participants. Convenience sampling made researcher easily get participant regarded inclusion and exclusion criteria. This sampling method saved time and met the participant's accessibility by involving this research.

3.6 Sample size estimation

Sample size calculation for specific objective 1 was calculated by using followed formula:

$$n = \left[\frac{z}{\Delta} \right]^2 (p (1 - p)) \quad -$$

Where,

n = estimated sample size

Z= standard value at 95% confidence level = 1.96

Δ= margin error set at 5%= 0.05

p= estimated proportion of university students who experience food insecurity=0.4

(Prevalence of food insecurity among Universiti Sains Malaysia students from the research (Nur & Norfarizan-Hanoon N.A, 2024)

Therefore,

$$n = \left[\frac{1.96}{0.05} \right]^2 (0.45 (1 - 0.45))$$

n = 380 + 20% drop-out compensation n = 456 participants

The sample size for specific objectives 2 and objective 3

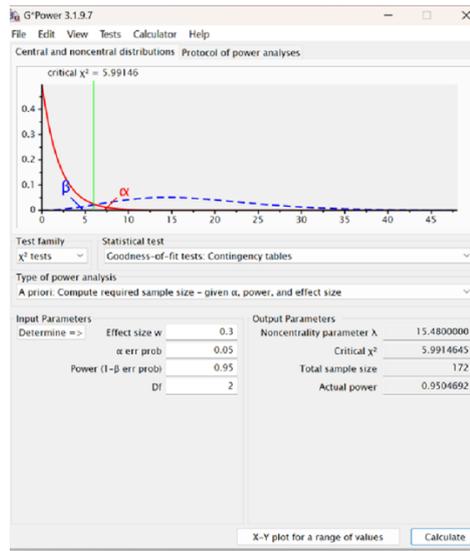


Figure 3.1: The calculation for specific objective 2 and specific objective 3 was carried out by using GPower software.

After excluding 20% drop-out compensation, the final total for specific objectives 2 and 3 was 206 participants.

Since $n=456$ is the highest value obtained from the calculation, it has been chosen as the final sample size in this study.

3.7 Research tool

The questionnaire used in this study consists of five sections:

Section 1: Demographic Data

Section 1 contains questions related to socio-demographic data information about age, gender, race, marital status, living accommodation, education level, field of study, monthly household income, primary source of allowance, household size, parental education level, and parental occupation (Appendix A).

Section 2: Malaysian Food Insecurity Experience Scale (MFIES)

The food insecurity of the participants was assessed using the Malaysian Food Insecurity Experience Scale (MFIES) (Appendix B). This questionnaire was translated into Malay and validated by (Roselawati *et al.*, 2021). The questionnaire used in this study because it first study was translated and validated in the Malaysian version (Roselawati *et al.*, 2021). The translation MFIES follows the guideline recommendation from the World Health Organization (WHO) (Roselawati *et al.*, 2021). The validation of this questionnaire used Rasch analysis, and the item of reliability is 0.97 which shows its high measurement will be confirmed (Roselawati *et al.*, 2021). This section consists of 8 questions. When respondents answer the questionnaire, yes or no scoring refers to Yes=1 and No=0 (Roselawati *et al.*, 2021). The category food insecurity scale is based on the total score (Table 1).

Table 3.1: Level of food insecurity (Jones, 2017)

Level of food insecurity	Scale
Food secure	0
Mild food insecure	1-3
Moderate food insecure	4-6
Severe food insecure	7-8

Section 3: International Physical Activity Questionnaire (IPAQ)

Physical activity levels of the university students had been assessed using the short form of the IPAQ (Appendix C). This questionnaire determined the physical activity levels of the students over the past 7 days. There were three specific types of activity that were assessed by this questionnaire: walking, moderate-intensity, and vigorous-intensity activity. Total physical activity levels of the students are calculated according to the formula in Table 2. The categorical score for physical activity classified as low, moderate, and high is based on IPAQ scoring.

Table 3.2 Formula used for calculating the level of physical activity

Physical activity	Score of physical activity (MET-minutes/week)
Walking	$3.3 \times \text{walking minutes} \times \text{walking days}$
Moderate-intensity activity	$4.0 \times \text{moderate-intensity activity minutes} \times \text{moderate-intensity days}$
Vigorous-intensity activity	$8.0 \times \text{vigorous-intensity activity minutes} \times \text{vigorous intensity days}$
Total physical activity	Sum of walking + Moderate + Vigorous METminutes/week scores

Section 4 Dietary Practices Questionnaire

The dietary practices questionnaire from the National Health and Morbidity Survey 2019 was adopted in this study to assess dietary practices for the past a week (Appendix D). The dietary practices questionnaire was publicly available in the NHMS 2019 Technical Report - Volume 1 (<https://iku.gov.my/nhms-2019>). This questionnaire consists of questions related to sugary drink intake (self-prepared drinks, carbonated and non-carbonated drinks, and premix drinks) as well as fruit and vegetable intake. The frequency of sugary drinks had categorized into none (0 days), rarely (1-2 days), and daily (6-7 days). The category of fruit and vegetable intake as adequate and inadequate consumption is 5 servings per day due to the Malaysian Dietary Guidelines recommendation of 3 servings of vegetables and 2 servings of fruit per day (Ministry of Health Malaysia, 2010).

Section 5 Anthropometry Data

Section 5 contains questions related to anthropometric measurements such as weight, height, and body mass index (BMI) (Appendix E). Weight was measured using a Seca 813 weighing scale and for height, a portable stadiometer Seca 213 both origin from Germany had been used for collecting participants' data. The measurements borrowed from the Dietetic laboratory in the Health Campus. A researcher took and measured the average of two readings. Participants needed to empty their pockets and take off their shoes before starting the measurements and the reading recorded to the nearest 0.1 kg. However, the participants needed to take off the shoes and stand straight for height measurement. The reading had been recorded near the 0.1 centimeter. For BMI calculation, the BMI formula $\text{weight kg per height (m)}^2$. The results are used to categorize the respondents as underweight, normal, overweight, and obese based on the World Health Organization (WHO).

3.8 Data collection method

Data collection for this study is conducted in the Health Campus of USM. Convenient sampling methods were applied to recruit the study participants. Potential participants based on the inclusion and exclusion criteria had been given brief information about this study. If they were interested in participating in this study, written informed consent was obtained from the students before data collection. The interview-administered questionnaire was used throughout the study. The questionnaire was constructed using a hardcopy form to collect data, which made it easier for students to participate. Potential participants were approached at the library, cafe, lecture halls, and both residential colleges. This study was published using a poster sent through WhatsApp groups to give the information regarding the time and location for conducting the study on that day.

The questionnaire is distributed to participants in these areas at any time. After answering the questionnaire, the researcher asked the respondents to do the anthropometry measurement to assess their Body Mass Index (BMI). Responders who answered the questionnaire in any specific area had been stated. The responder asked to go to the Dietetics laboratory to assess their height and weight measurements at any time they were free. They got the reminder through WhatsApp to go to the Dietetics laboratory to measure their weight and height there. However, for the participants who were recruited at a residential college, height and weight were assessed in their room or lobby.

3.9 Data analysis

Data was analyzed using statistical analysis (SPSS), Version 29.0. The categorical data are presented as numbers and frequencies. Continuous data with normal distribution presented as mean and standard deviation, while skewed distributed data was presented as median and interquartile range or quartile. Descriptive statistics were performed to determine the prevalence of food insecurity among undergraduate students in the Health Campus, USM. Pearson's Chi-Square test is used to determine the association between food security status and physical activity levels, and the association between food security status and dietary practices of university students.