THE ASSOCIATION BETWEEN FOOD DELIVERY SERVICES USAGE, BMI, AND WAIST CIRCUMFERENCE: A STUDY AMONG UNDERGRADUATE STUDENTS IN THE SCHOOL OF HEALTH SCIENCES, USM KUBANG KERIAN, KELANTAN

YASMIN MUKHLISAH BINTI MOHD FAIZAL

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By

YASMIN MUKHLISAH BINTI MOHD FAIZAL

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Declaration

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

…………………………….

Yasmin Mukhlisah binti Mohd Faizal

Date: …………………………….

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TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

LIST OF ABBREVIATION

BMI   Body Mass Index

FDS   Food Delivery Services

IIUM   International Islamic University Malaysia

OFDS   Online Food Delivery Services

UPSI   Univeristi Pendidikan Sultan Idris

USM   Universiti Sains Malaysia

WC   Waist Circumference

WHO   World Health Organization

HUBUNGAN ANTARA PENGGUNAAN PERKHIDMATAN PENGHANTARAN MAKANAN, BMI, DAN UKUR LILIT PINGGANG: KAJIAN DI KALANGAN PELAJAR SARJANA MUDA, FAKULTI SAINS KESIHATAN, USM KUBANG KERIAN, KELANTAN

ABSTRAK

Kajian ini menyiasat perkaitan antara penggunaan perkhidmatan penghantaran makanan dan ukuran antropometrik, khususnya Indeks Jisim Badan (BMI) dan lilitan pinggang, dalam kalangan pelajar sarjana muda di Pusat Pengajian Sains Kesihatan, Universiti Sains Malaysia Kubang Kerian (USMKK). Memandangkan pelajar sering mempunyai jadual yang padat, perkhidmatan penghantaran makanan telah menjadi kemudahan popular untuk mendapatkan makanan dengan cepat dan mudah. Walau bagaimanapun, terdapat kebimbangan tentang kekerapan penggunaan perkhidmatan ini boleh menjejaskan kesihatan pelajar, terutamanya kerana banyak makanan yang dihantar cenderung kepada makanan segera atau pilihan yang kurang berkhasiat. Kajian keratan rentas telah dijalankan dengan pelajar berumur 18 hingga 25 tahun dari program Sains Kesihatan yang melibatkan seramai 105 pelajar. Persampelan kemudahan digunakan untuk memilih peserta. Keputusan menunjukkan bahawa, majoriti peserta (59%) menggunakan perkhidmatan penghantaran makanan seminggu sekali. Dapatan juga mendedahkan bahawa kebolehcapaian dan kemudahan, tawaran promosi dan masa yang terhad untuk memasak adalah sebab utama yang mempengaruhi penggunaan perkhidmatan penghantaran makanan dengan 33.0%, 22.3% dan 18.1% responden masing-masing menyatakan

faktor ini. Walau bagaimanapun, hasil daripada keputusan statistik menunjukkan bahawa tidak terdapat perkaitan yang signifikan antara kekerapan penggunaan penghantaran makanan dengan Indeks Jisim Badan, BMI (p=0.977) dan ukur lilitan pinggang (p=0.458) kerana kesemua nilai p > 0.05. keputusan ini selanjutnya menggambarkan bahawa penggunaan perkhidmatan penghantaran makanan tidak semestinya atau secara langsung mempengaruhi pengukuran antropometrik, melainkan faktor-faktor lain yang mempengaruhi seperti persekitaran, psikologi dan gaya hidup dimasukkan. Penyelidikan ini bertujuan untuk memberikan maklumat berguna tentang cara bergantung pada penghantaran makanan boleh mempengaruhi berat badan dan risiko kesihatan pelajar. Dengan mempunyai pemahaman yang lebih baik mengenai hubungan ini boleh membantu universiti membangunkan program kesihatan yang lebih baik dan menggalakkan tabiat pemakanan yang lebih sihat dalam kalangan pelajar. Kajian ini penting memandangkan Malaysia sedang melihat peningkatan dalam kadar berat badan berlebihan dan obesiti dan tabiat pemakanan orang dewasa muda memberi impak yang besar kepada kesihatan jangka panjang mereka.

THE ASSOCIATION BETWEEN FOOD DELIVERY SERVICES USAGE, BMI, AND WAIST CIRCUMFERENCE: A STUDY AMONG UNDERGRADUATE STUDENTS IN THE SCHOOL OF HEALTH SCIENCES, USM KUBANG KERIAN, KELANTAN

ABSTRACT

This study investigate the association between the usage of food delivery services and anthropometric measurements, specifically Body Mass Index (BMI) and waist circumference, among undergraduate students at the School of Health Sciences, Universiti Sains Malaysia Kubang Kerian (USMKK). Given that students often having hectic schedules, food delivery services have become a popular convenience to get meals quickly and easily. However, there are concerns about how frequently using these services might affect students' health, especially since many delivered meals tend to be fast food or less nutritious options. A cross-sectional study was conducted with students aged 18 to 25 from Health Sciences programmes that involved a total of 105 students. Convenience sampling was used to choose the participants. Result showed that, majority of the participants (59%) used food delivery services once a week. The findings also revealed that accessibility and convenience, promotional offers and limited time to cook are the main reasons that influenced the use of food delivery services with 33.0%, 22.3% and 18.1% of respondents citing these factors respectively. However, statistical results indicated that there are no significant association between frequency of food delivery usage with BMI ($p=0.977$) and waist circumference ($p=0.458$) as all p-values > 0.05. these results further illustrated that the

usage of food delivery services does not necessarily or directly affecting anthropometric measurement, unless other influencing factors such as environment, psychological and lifestyle were included. This research aims to provide useful information on how relying on food delivery might influence students' body weight and health risks. By having better understanding regarding these connections can help universities develop better health programs and encourage healthier eating habits among students. This study is important given that Malaysia is seeing an increase in overweight and obesity rates and that young adults' eating habits have a significant impact on their long-term health.

CHAPTER 1: INTRODUCTION

1.1 Study Background

Nowadays, students were busy juggling between classes, playing sports and taking part in extracurricular activities, that their daily meals were affected (Mustafa, 2018). Food delivery services has become a trend that is also a vital solution to ensure these students get their daily, proper meal in spite of their packed schedule. This service allows users to order food from local restaurants through their website or app. This gives users easy access to food while relieving them from needing to prepare or shop for their food. Customers can directly place their orders through electronic devices, and they can choose to pick up their food or have it delivered to a certain location (Ambad et al, 2022). Yeo (2017) state that there are two types of retailers who can offer meal delivery services. The retailer itself comes first. The majority of this group consists of fast-food businesses such as McDonald's, Pizza Hut, Domino's Pizza, and Kentucky Fried Chicken (KFC). The second category is made up of several restaurants that serve as middlemen and provide delivery services. For example, GrabFood, Foodpanda, DahMakan, Bungkusit, Uber Eats, and LalaMove (Zimu, 2022).

The meal delivery industry in Malaysia has grown considerably, and companies such as GrabFood and Food Panda have gained recognition (Lau, 2019). Food delivery services has grown to be a significant component of Malaysia's food and beverage industry. This service offers a convenient substitute for traditional meal options like ordering takeaway or dining in (Sahidi et al., 2022). In addition to online platforms, food orders can also be placed via phone call or Whatsapp. For example, customers can simply text the restaurant, stating their order and

delivery location. In about 20 to 30 minutes, depending on the order list and or the weather, the food will be delivered at the location by their designated driver or rider. This pattern highlights how much more reliant college students are on food delivery services to get by daily. New Straits Times reported that University Putra Malaysia (UPM) recognized the value of this service and introduced the Putra Food Delivery Service after it was discovered that many students were leaving campus to acquire food. (Mustafa, 2018). Given the lack of information on food delivery service usage among undergraduate students at USM Kubang Kerian (USMKK), Kelantan's School of Health Sciences, the study aims to determine the association between the use of food delivery services, BMI and waist circumference among undergraduate students.

1.2 Problem statement

Food delivery services are a major trend in Malaysia's food and beverage industry. In addition to takeout and dining in at restaurants, eating out is now possible through food delivery services (Sahidi et al, 2022). Recent studies indicate that food delivery services have become a significant trend in Malaysia's food and beverage industry, particularly among university students who face hectic academic schedules (Sahidi et al, 2022). National surveys reveal that almost half of undergraduate students use food delivery services at least 2 to 3 times per week with some exceeding five times per week, showing a major shift towards convenience in meal sourcing (Sahidi et al, 2002). This change in eating behaviour raises critical public health concerns as frequent consumption of food from food delivery services, often characterized by high caloric density, unhealthy fats, sugars and sodium, which may negatively impact students' nutritional status and increase their risk of overweight, obesity and also non-communicable diseases, such as diabetes, hypertension and hyperlipidemia (Yoon & Shoon, 2020).

Despite these concerns, there is still limited research specifically examining the types and frequency of food delivery service usage among Malaysian undergraduate students and how these patterns relate to measurable health outcomes such as Body Mass Index (BMI) and waist circumference (WC), which are key indicators of obesity and metabolic risk according to World Health Organization (WHO), 2021. This study aims to fill this gap by investigating the association between food delivery service usage, BMI and waist circumference among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia. The findings can provide valuable insights for developing targeted nutrition intervention reduce the rising burden of nutrition-related chronic diseases in this population.

1.3 Research Question

Is there any association between food delivery services usage with BMI and waist circumference among undergraduate students in School of Health Sciences in USMKK, Kelantan?

1.4 Research Objective

1.4.1 General objective

To determine the association between food delivery services usage with BMI and waist circumference among undergraduate students in School of Health Sciences in USMKK, Kelantan.

1.4.2   Specific objectives

- To determine the food delivery services usage among undergraduate students in School of Health Sciences, USM Kubang Kerian.
- To determine the BMI among undergraduate students in School of Health Sciences, USM Kubang Kerian.
- To determine the waist circumference among undergraduate students in School of Health Sciences, USM Kubang Kerian.
- To determine the association between food delivery services usage and BMI among undergraduate students in School of Health Sciences, USM Kubang Kerian.

- To determine the association between food delivery services usage and waist circumference among undergraduate students in School of Health Sciences, USM Kubang Kerian.

1.5 Research Hypothesis

- Null hypothesis (H_o): There is no association between food delivery services users and Body Mass Index (BMI) among undergraduate students in School of Health Sciences at USMKK, Kelantan.

- Alternative hypothesis (H_A): There is an association between food delivery services users and Body Mass Index (BMI) among undergraduate students in School of Health Sciences at USMKK, Kelantan.

- Null hypothesis (H_o): There is no association between food delivery services users and waist circumference among undergraduate students in School of Health Sciences at USMKK, Kelantan.

- Alternative hypothesis (H_A): There is an association between food delivery services users and waist circumference among undergraduate students in School of Health Sciences at USMKK, Kelantan.

1.6 Conceptual Framework
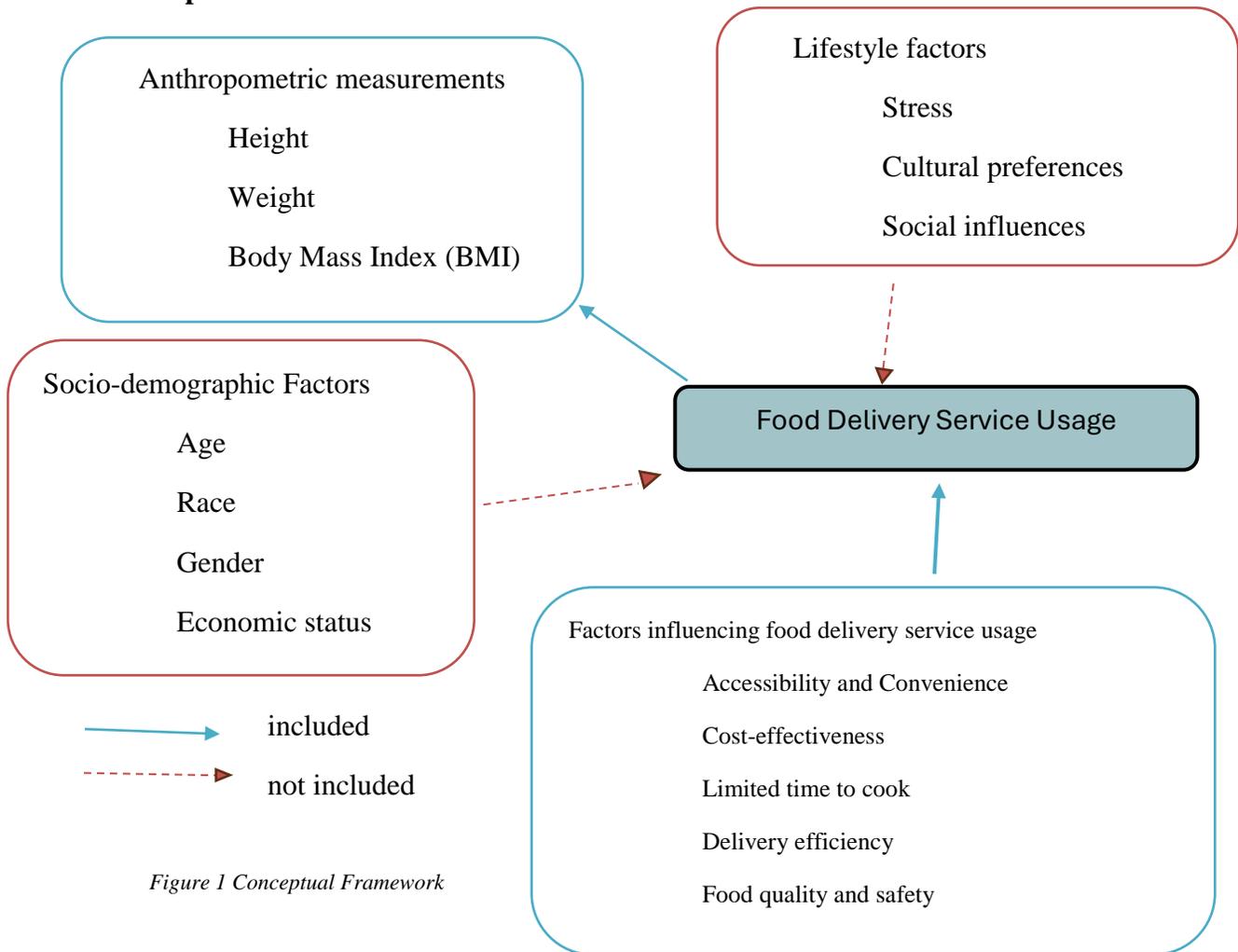
Figure 1 Conceptual Framework

The conceptual framework above was adapted from Aonallah-Skhiri et al (2011). This study aims to determine the association between food delivery services, body mass index (BMI) and waist circumference. There are several factors that affect the use of food delivery services. For example, accessibility and convenience, cost-effectiveness, limited time to cook, delivery efficiency, food quality and safety, and promotional offers and incentives. Food delivery service usage also can be influenced by lifestyle factors such as stress, cultural preferences, social influences and socio-demographic factors but it would not be included in the study.

CHAPTER 2: LITERATURE REVIEW

2.1 The rise of food delivery service and eating behavior

Eating behaviour can be influenced by multiple factors, such as genetic, physiological, psychological, cultural, social and situational. This behaviour can be described as subjective motivation to eat which are appetite, hunger, and satiety. It also can be defined as amount and type of food and energy ingested, structure of dietary pattern, macronutrients profile and the frequency and timing of eating (Stubbs et al., 2015). Previous research stated that food delivery services are primarily found in the urban areas such as Penang, Kuala Lumpur and Johor Bahru (Yat, 2019). This development could be associated with the increasing number of people who live in the area. It can be working adults who were occupied with daily tasks and routine or students who were busy with their daily class schedule, assignments and maybe with their extra-curricular activities. Both who are in need of quick and easy meal during the day or after a long day (Mustafa, 2018). However, several studies has shown that not eating at home as in home-cooked meal may result in a high body mass index (BMI).

Previous studies have categorized food delivery services as "junk food on demand", since they provide restaurant meals and fast food more conveniently (Buettner et al, 2023). Based on a poll conducted by Rakuten Insight in April 2023, 76% of Malaysian respondents said they had ordered fast food using food delivery services, while 59% said they had chosen to order local cuisine using these services (Siddharta, 2023). In conformity with the same survey, 79% of respondents between the age of 16 and 24 stated that they preferred using food delivery service to purchase fast food. These statistics are possible because of the easy access to the food delivery

service through food delivery apps, such as Food Panda and GrabFood. Furthermore, young adults' lifestyle usually doesn't leave too much time for them to think about meal preparation, which makes food delivery seem very appealing as it solves many of their problems regarding daily meals. This reliance on food delivery services through these apps may indirectly shape their eating behaviours as they were consuming food in the same manner almost every day.

2.2 Association between food delivery services usage and sociodemographic factors

Food delivery services usage has increased at a remarkable rate all over the world. This could be due to its convenience, cost effectiveness and the variation of cuisines available and all of this is just at the tip of their fingers (Dsouza and Sharma, 2020). According to Hall and Dornan (2002), sociodemographic characteristics includes age, ethnicity, gender, social status, income, education, marital status and family size. Even so, this study will only emphasize four aspects of sociodemographic characteristics, which are age, gender, ethnicity and socioeconomic status. Younger adults aged 18 to 25 are most likely the population that uses food delivery services as stated in a previous study (Buettner et al, 2023). This is because individuals within this age range are more familiar with the technology and likely to seek out convenience regarding their daily meals in their busy lifestyle. In terms of gender, there were conflicting studies as research showed that percentage of females using food delivery service were higher than male (Humaidi et al, 2024).

Race and ethnicity also significantly impact the use of food delivery services as different ethnic groups and culture reflect diverse preferences in foods. However, among them all, the highest use of food delivery services is Malay with 62% in comparison to Chinese and Indian (29% and 9% respectively). This highlights how racial and ethnic backgrounds influence the use of food delivery services. Next, focusing on socioeconomic status (SES), it can be defined as a measure of an individual's economic and social status and usually associated with better health (Baker, 2014). Adler and Ostrove (2006) also stated that on average people's health generally improves with their level of advantage. Therefore, individuals with higher socioeconomic status

(SES) are more likely to utilize food delivery services due to their better financial resources and

advantages, compared to those with low-income levels (Cummins et al, 2024).

2.3 Anthropometric measurements

According to NHMS (2019), a survey was conducted, and the findings showed that 50.1% of adults in Malaysia were overweight and obese (30.4% and 19.7% respectively). The survey also reveals that 52.6% of adults had abdominal obesity. These findings raised alarming concern regarding public health in Malaysia. The National Library of Medicine stated that anthropometric measurements are quantitative process of acquiring measurements of human body, non-invasively (Casadei and Kiel, 2022). Anthropometric measurements have been used for many purposes, such as risk assessment, intervention, and evaluation of the effects on health or nutritional status (Picueras, 2021). There are a few anthropometric measurements that are common and easily done. For example, weight and height that can give us our Body Mass Index (BMI), body circumference, such as waist, hip and mid-upper arm and from the body circumference, it can generate waist-hip ratio (Sanchez-Gracia, 2007).

It has been widely known that BMI is a reliable predictor of disease, especially non-communicable disease, such as the ones stated above, while waist circumference (WC) has been an indicator for abdominal obesity. However, BMI paired with WC has been said to assess health risk better than using BMI alone. According to the World health Organization (WHO), BMI can be classified into several categories, such as underweight, normal, overweight and obese. BMI for underweight categories is less than 18.5 kg/m^2 while BMI of 18.5 – 22.9 kg/m^2 is classified as normal. Adults with BMI 23.0 – 24.9 kg/m^2 are considered overweight, while those with BMI greater than or equal to 25 kg/m^2 are classified as obese (Obesity and Overweight, 2024).

However, for this study, BMI will be categorized into two classifications which are normal and not normal. BMI not normal will include underweight, overweight and obese categories.

Waist circumference (WC) has become an important measurement in determining health risk, especially regarding abdominal obesity. Previous research conducted by Ross et al. (2020) also strongly urged that waist circumference (WC) be included in clinical practice as a routine measurement. This study also highlighted that body mass index (BMI) alone cannot assess obesity-related health problems. According to International Diabetes Federation, the waist circumference cut-off points for South Asians for men > 90 cm and women > 80 cm. These cut-off points are important to identify the individuals who are at risk of metabolic and cardiovascular disease that is associated with abdominal obesity (Ross et al., 2020).

2.4 Association between food delivery services usage and BMI

The rapid growth of food delivery services has raised concerns about its impact on body mass index (BMI) among young adults, particularly university students who frequently rely on these platforms for convenience (Ab Hamid et al, 2024). A cross-sectional study among 150 Malaysian undergraduate students found that 71.3% used food delivery services with fast food being the most ordered category, and a Pearson chi-square test revealed a statistically significant association between food delivery services usage and BMI categories ($p<0.05$), suggesting that higher usage correlates with elevated BMI due to prioritizing price over nutritional value (Ab Hamid et al, 2024).

Internationally, a Chinese study on university students using the social-ecological model reported that higher food delivery frequency usage, results in increases BMI (regression coefficient=0.418, $p<0.001$), especially among those with higher living expenses who choses for calorie dense options. On the other hand, the same study showed that healthier food delivery choices inversely correlated with BMI (standardized coefficient=-0.110, $p<0.05$) (Yang., 2025). Collectively, these studies underlined the need for interventions promoting healthier food choices while using food delivery to mitigate BMI increases among university students.

2.5 Association between food delivery services usage and waist circumference

Food delivery services have been specifically linked to waist circumference (WC), a superior indicator of abdominal obesity and metabolic risks, particularly among female university students in IIUM (Mokhtazar & Hamiruddin, 2020). In this study conducted at IIUM which involved 85 of undergraduate female students, 75.2% used delivery for fast food, showing no significant BMI association (p=0.240) but a clear link with waist circumference (p=0.039), where lower delivery frequency correlated with reduced waist circumference and abdominal obesity prevalence (mean WC=68.82 cm) (Mokhtazar & Hamiruddin, 2020). This suggests that delivery habit promote central fat accumulation via high-fat, high-sugar meals, even among normal BMI individuals.

Suburban university students in China exhibited elevated WC risk from frequent usage of food delivery service usage because of poor cafeteria access (mean BMI higher by 1.22 kg/m^2), reinforcing environmental influences on central obesity (Yang, 2025). These patterns align with broader evidence that out of home eating elevates WC through portion sizes and nutrient-poor profiles (Ismail et al, 2024). The consistent WC association across studies emphasizes food delivery services as a modifiable risk factor for abdominal obesity in students, therefore warranting platform-based health nudges and policy reforms. While BMI links vary, WC emerges as a more sensitive marker for delivery-related adiposity changes (Chan & Moy, 2025).

CHAPTER 3: METHODOLOGY

3.1 Research Design

In this study of food delivery service and its association with BMI and waist circumference among undergraduate students from the School of Health Sciences in USMKK, the study design used was cross-sectional study. A cross-sectional study can be defined as a type of observational research design that involved collection of relevant information (data) at one specific point in time (Kesmodel, 2018). The study further revealed that a cross-sectional study also can utilized for analytical purposes of association between an exposure and an outcome. Apart from that, cross-sectional studies are known to be less expensive to conduct compared to other types of studies as it does not require any follow-up data collection over time (Levin, 2006). Cross-sectional studies also enable researchers to collect data faster. Hence, making analyzation and interpretation of data more manageable (Setia, 2016).

3.2 Study Area

The study was conducted in Universiti Sains Malaysia Health Campus, Kubang Kerian, Kelantan to ensure a diverse sample of participants. This was due to the fact that the participants come from a variety of backgrounds with diverse food preferences and different eating behaviour. The respondents also will include different races, ethnicity, genders, ages and socioeconomic backgrounds. Furthermore, USM Health Campus is located in a relatively urban area. This gives students many choices and options regarding their food preferences as they can find numerous types of cuisine and dishes, therefore affecting the usage of food delivery services.

3.3 Study Population

The targeted study population will be the undergraduate students from the School of Health Sciences which comprise of nine courses: Dietetics, Nutrition, Forensic Science, Exercise and Sport Science, Audiology, Speech Pathology, Environmental and Occupational Health, and Nursing. The study will include the first year until the fourth-year students. The age range for participation is set between 18 to 25 years old as it is the usual age range of undergraduate students enrolled in university education (Kula, 2016). Postgraduate students are excluded from this study as most of them do not live in the hostel and are either married or have better and more stable finance compared to undergraduate students (Maharaj, 2018). Other than postgraduate students, international students are also excluded from this study. This is because international students often experience social exclusion due to language and cultural barriers, which can affect their transition into campus life and their food choice (Soylemez-Karakoc et al, 2023). The same study also shows that international students, especially the ones who are married, are more likely to exclude themselves from participating in university's social events. Therefore, this difference may impact the use of food delivery service among international students, thus making them less representative of the study population.

3.4 Subject Criteria

3.4.1 Inclusion

- All undergraduate students from School of Health Sciences

- Students aged 18 to 25 years old.

3.4.2 Exclusion

- International students.

3.5 Sample Size Estimation

The formula that will be used to calculate the sample size in this study is:

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

$$n = sample\ size$$

$$Z = value\ represents\ the\ confidence\ level\ (95\%)$$

$$\Delta = margin\ of\ error$$

$$p = anticipated\ proportion\ of population$$

3.5.1 Sample size estimation for food delivery service users

For the sample size calculation of this study, the confidence interval is set at 95% with Z-score value of 1.96 with 5% margin of error. Based on previous study by Sahidi et al (2022), the prevalence of food delivery services usage is 8.1%. Therefore, the anticipated proportion of population used for this study is 0.081. Hence, the number of participants require for this study would be 143 participants

$$n = \left[\frac{1.96}{0.05}\right]^2 0.081(1-0.081)$$

$$n = 114.39 + 20\%\ non\ response\ rate$$

$$n = 142.99 \sim 143\ samples$$

3.5.2 Sample size estimation for BMI

For the sample size calculation of this study, the confidence interval is set at 95% with Z-score value of 1.96 with 5% margin of error. Based on previous study by Wan et al (2021), the prevalence of BMI for obese participants is 8.5%. Therefore, the anticipated proportion of population used for this study is 0.085. Hence, the number of participants require for this study would be 149 participants.

$$n = \left[\frac{1.96}{0.05}\right]^2 0.085(1 - 0.085)$$

$$n = 119.51 + 20\% \ non \ response \ rate$$

$$n = 149.39 \sim 149 \ samples$$

3.5.3 Sample size estimation for waist circumference

For the sample size calculation of this study, the confidence interval is set at 95% with Z-score value of 1.96 with 5% margin of error. Based on previous study by Mokhtazar & Hamiruddin (2020), the prevalence of waist circumference that categorized as high risk is 6%. Therefore, the anticipated proportion of population used for this study is 0.06. Hence, the number of participants require for this study would be 108 participants.

$$n = \left[\frac{1.96}{0.05}\right]^2 0.06(1 - 0.06)$$

$$n = 86.67 + 20\% \ non \ response \ rate$$

$$n = 108.33 \sim 108 \ samples$$

3.5.4 Sample size estimation for association between food delivery services usage and BMI

$$n = \frac{p1(1-p1) + p2(1-p2)}{(p1-p2)^2} + (z\alpha + z\beta)^2$$

$$n = sample\ size$$

$$p = anticipated\ proportion\ of\ population$$

$$\alpha = level\ of\ statistical\ significance$$

$$z\alpha = 1.96(\alpha = 0.05)$$

$$z\beta = 0.84(80\%\ power)$$

For the sample size calculation of this study, the confidence interval is set at 95% with Z-score value of 1.96 with 5% margin of error and the power of this study has been set at 80%. Based on previous study, the prevalence of food delivery usage is 10.3% (Al Kharusi et al, 2025). Hence, the anticipated proportion of population (p1) used for this calculation is 0.103. From other studies, it also shows that the prevalence of BMI for overweight to obese category among undergraduate university students is 12.7% (Ab Hamid et al, 2024). Therefore, the anticipated proportion of population (p2) that is going to be used for this calculation is 0.13. Hence, the number of participants require for this study would be 15 participants.

$$n = \frac{0.103(1-0.103) + 0.13(1-0.13)}{(0.103-0.13)^2} + (1.96 + 0.84)^2$$

$$n = 11.63 + 20\%\ non\ response\ rate$$

$$n = 14.53 \sim 15\ samples$$

3.5.5 Sample size estimation for association between food delivery services usage and waist circumference

For the sample size calculation of this study, the confidence interval is set at 95% with Z-score value of 1.96 with 5% margin of error and the power of this study has been set at 80%. Based on previous study, the prevalence of food delivery usage is 10.3% (Al Kharusi et al, 2025). Hence, the anticipated proportion of population (p1) used for this calculation is 0.103. From other studies, it also shows that the prevalence of waist circumference that categorized as high risk is 6% (Mokhtazar & Hamiruddin, 2020). Therefore, the anticipated proportion of population (p2) that is going to be used for this calculation is 0.06. Hence, the number of participants require for this study would be 110 participants.

$$n = \frac{0.103(1-0.103) + 0.06(1-0.06)}{(0.103-0.06)^2} + (1.96+0.84)^2$$

$$n = 88.31 + 20\% \, non \, response \, rate$$

$$n = 110.39 \sim 110 \, samples$$

Based on the calculations, the range of sample size falls between 15 to 149 participants. Hence, a total of 149 participants will be required in this study.

3.6 Sampling Method

Convenience sampling will be used to recruit participants. It is one of the non-probability sampling techniques that select participants based on accessibility (Golzar et al, 2022). This technique provided a few benefits such as cost-effective and less time-consuming. Participants will consisted of readily available and willing students to engage in the study, give information into their usage food delivery service, sociodemographic characteristics and their anthropometric measurements. The participants were provided with consent form prior to their participation in the study. Online enrollment poster was distributed to participants with information of the study, including the inclusion and the exclusion criteria of the study. The participant who met the inclusion criteria will be taking part in the study.

3.7 Research Tool

3.7.1 Online questionnaire

This self-administered online questionnaire consists of 2 sections; Section A: Sociodemographic data and Section B: Food delivery services usage data. All participants were required to answer all questions in each section. The questionnaire was obtained from Mokhtazar and Hamiruddin (2020) via email. The first section of the questionnaire includes the participants' gender, age, ethnicity, year of study and their courses.

Section A: **Sociodemographic data**

    i.   Gender

    i.   Age

    ii.   Ethnicity

   iii.   Year of study

   iv.   Courses

Section B: **Food delivery service usage data**

    i.   Frequency of food delivery usage per week

    ii.   Reasons of using food delivery services

   iii.   Types of food ordered

   iv.   Timing of food delivery service usage

3.7.2 Anthropometric measurements

The question about anthropometric measurements such as body weight, height, body mass index (BMI) and waist circumference are not included in the questionnaire. All anthropometric measurements will be measured by the researcher to ensure the accuracy of this study. After answering the questionnaire, the participants will be presented with several options of dates and times for their anthropometry measurements. The weighing scale should be placed on a hard, flat surface. The participants will be asked to dress in light clothing. During measurement, they will be instructed to take off their shoes, jewelry, watch, belt and they also need to empty their pocket before any measurement is taken. Researcher will ask the participants to step on the weighing scale and stand up straight with their hand by their side. The reading of weight, height and waist circumference will be taken twice, but if the difference between the first two readings is more than 1%, third reading will be taken. The body weight (in kg) and height (in meter) will be used to calculate participants' body mass index (BMI), using the formula

$$BMI = \frac{weight\ (kg)}{height\ (m)^2}$$

As for the waist circumference, measurements will be taken using a measuring tape over the light clothing at the narrowest point between the lower costal border and iliac crest (Ostchega et al., 2019).

3.8 Data Collection Method

Data collection for this study involved a self-administered online questionnaire and anthropometry measurements that will be conducted by the researcher. The estimation date for data collection is set in March 2025 after ethical permission from the Human Research Ethics Committee of USM (JEPeM), was acquired. Participants will be recruited through an online poster that will be distributed via WhatsApp. The poster will have a brief description of the study including a link to the Google Form containing the questionnaire as well as the inclusion and exclusion criteria. Afterward, the participants who meet the criteria will fill in the questionnaire that consists of the usage of food delivery services. Through this self-administered online questionnaire, it will reduce the burden on participants and the researcher, eliminating the need for printed forms. Following that, participants will be added to a Whatsapp group, where the participants will receive a more detailed briefing about the study, and they will also be given several options for dates and times that are convenient for both researcher and the participant to obtain their anthropometric measurements. The anthropometric measurements will consist of participants' weight, height, BMI and waist circumference.