THE ASSOCIATION BETWEEN DIETARY FIBRE INTAKE, BODY MASS INDEX (BMI) AND LIFESTYLE PATTERNS WITH CONSTIPATION AMONG UNDERGRADUATE STUDENTS IN THE SCHOOL OF HEALTH SCIENCES, UNIVERSITI SAINS MALAYSIA (USM), KELANTAN.

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SCHOOL OF HEALTH SCIENCES

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SCHOOL OF HEALTH SCIENCES, UNIVERSITI SAINS MALAYSIA

(USM), KELANTAN.

By

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Dissertation submitted in partial fulfilment of the requirements for the

degree of Bachelor of Health Science (Honours) (Dietetics)

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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 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.

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Nurin Athirah binti Ahmad Shazalli

Date: 1st July 2025

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LIST OF ABBREVIATIONS

BMI   Body Mass Index

USM   Universiti Sains Malaysia

NHMS   Malaysia National Health and Morbidity Survey

WHO   World Health Organisation

SPSS   Statistical Package for the Social Sciences

HUBUNGKAIT ANTARA PENGAMBILAN SERAT MAKANAN , INDEKS JISIM BADAN (BMI) DAN CORAK GAYA HIDUP DENGAN SEMBELIT DALAM KALANGAN PELAJAR SARJANA MUDA DI PUSAT PENGAJIAN SAINS KESIHATAN, UNIVERSITI SAINS MALAYSIA (USM), KELANTAN.

ABSTRAK

Sembelit adalah masalah usus yang biasa berlaku dengan peningkatan kelaziman di Malaysia dan boleh menjejaskan individu dari semua peringkat umur, termasuk pelajar universiti. Kajian ini bertujuan untuk mengkaji hubungkait antara pengambilan serat makanan, indeks jisim badan (BMI), dan corak gaya hidup dengan sembelit dalam kalangan pelajar sarjana muda di Pusat Pengajian Sains Kesihatan, Universiti Sains Malaysia (USM), Kelantan. Kajian keratan rentas ini melibatkan 163 pelajar sarjana muda dari Pusat Pengajian Sains Kesihatan, melalui kaedah persampelan yang mudah. Pengumpulan data telah dijalankan bermula April 2025 hingga Mei 2025. Data dikumpul menggunakan soal selidik atas talian yang diisi sendiri oleh responden, yang merangkumi ciri demografi, penilaian pengambilan serat makanan (Soal Selidik Kekerapan Pemakanan Serat Separa Kuantitatif), corak gaya hidup dan penilaian sembelit (*Wexner Constipation Scoring System*). Pengukuran antropometrik telah dilakukan untuk menentukan indeks jisim badan (*BMI*). Data yang dikumpul dianalisis menggunakan *Statistical Package for the Social Sciences* (SPSS) versi 29.0. Perkaitan yang signifikan telah dikenal pasti antara pengambilan serat makanan dan sembelit (p=0.002). Tiada perkaitan yang signifikan ditemui antara *BMI* dan sembelit (p=0.697). Tambahan pula, tiada hubungan yang signifikan antara corak gaya hidup dan sembelit (p=0.805). Perkaitan ketara yang dikenal pasti antara pengambilan serat makanan dan sembelit menekankan kepentingan pengambilan serat makanan yang mencukupi, terutamanya dalam kalangan pelajar universiti, yang didapati mengambil serat kurang daripada

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pengambilan yang disyorkan iaitu ≥25 g/hari. Oleh itu, adalah dicadangkan agar kajian akan datang dijalankan untuk meningkatkan pemahaman tentang faktor-faktor yang menyumbang kepada sembelit dan menangani kekurangan pengambilan makanan berserat dalam kalangan pelajar universiti.

THE ASSOCIATION BETWEEN DIETARY FIBRE INTAKE, BODY MASS INDEX (BMI) AND LIFESTYLE PATTERNS WITH CONSTIPATION AMONG UNDERGRADUATE STUDENTS IN THE SCHOOL OF HEALTH SCIENCES, UNIVERSITI SAINS MALAYSIA (USM), KELANTAN.

ABSTRACTS

Constipation is a common bowel issue with increasing prevalence in Malaysia and can affect individuals of all age groups, including university students. This study aims to investigate the association between dietary fibre intake, body mass index (BMI), and lifestyle patterns with constipation among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia (USM), Kelantan. This cross–sectional study included 163 undergraduate students from the School of Health Sciences, recruited through a convenience sampling method. Data collection took place from April 2025 to May 2025. Data were collected via an online self-administered questionnaire that encompassed demographic characteristics, assessment of dietary fibre intake using the Semi-Quantitative Dietary Fibre Food Frequency Questionnaire, lifestyle patterns, and evaluation of constipation using the Wexner Constipation Scoring System. Anthropometric measurements were conducted to determine Body Mass Index (BMI). The data collected were analysed using the Statistical Package for the Social Sciences (SPSS) software, version 29.0. A significant association was identified between dietary fibre intake and constipation (p=0.002). No significant association was found between BMI and constipation (p=0.697). Furthermore, there was no significant relationship between lifestyle patterns and constipation (p = 0.805). The notable association identified between dietary fibre consumption and constipation underscores the importance of ingesting sufficient dietary fibre, particularly among university students, who are observed to consume less than the recommended intake of ≥25 g/day. Therefore, it is

recommended that future research be conducted to enhance comprehension of the factors contributing to constipation and to address deficiencies in dietary fibre intake among university students.

CHAPTER 1: INTRODUCTION

1.1 Study Background

Constipation is a gastrointestinal issue affecting people worldwide, and its occurrence keeps increasing. The definition of constipation has differed over the years, but it can be described as having fewer than three bowel movements in a week according to the Rome III criteria (Sanchez and Bercik, 2011). Diaz *et al.* (2023) stated that anyone can be affected by constipation because it is not specific to any age, gender, race, or socioeconomic status. According to Sumida *et al.* (2020), constipation is a common issue that healthcare practitioners must address in their daily clinical practice. This research focuses on university students because existing studies indicate a higher prevalence of constipation within this age group. This can be supported by the previous research that emphasises university students, who are often characterised by poor health-related behavioural habits (Yusop and Yasin, 2021). The occurrence of constipation is very common in the general population due to its multifactorial causes. Therefore, this study aims to identify the possible risk factors associated with the development of constipation.

Inadequate dietary fibre intake is worrying regardless of age group, as it may increase the risk of constipation. Yusop and Yasin (2021) found that the percentage of students who achieved dietary fibre intake based on the recommended intake of 20-30 grams per day was only 11%. To maintain overall health, particularly gut health, it is very crucial to consume adequate dietary fibre. Dietary fibre (DF) is the part of plants which are safe to be eaten and can be entirely or partially fermented in the large intestine but remains undigested and unabsorbed in the small intestine (He *et al.*, 2022). It is not digested because mammals lack the enzymes to hydrolyse these polymers into monomers in the small intestine (Turner and Lupton, 2021).

Other than that, lifestyle patterns are also considered as contributing factors to constipation. Lifestyles are often regarded as a life process that can be shaped by environmental factors, cultural beliefs, and norms. In this study, lifestyle patterns encompass the frequency of exercise per week, daily fluid intake and fruit and vegetable intake. Adequate fluid intake is important because it helps facilitate the absorption of dietary fibre, increasing stool weight and softening stools (Ismail *et al.*, 2022). The findings from Silveira *et al.* (2021) study highlighted the vital role of fibre and fluid consumption in preventing constipation. Silveira *et al.* (2021) also reported that individuals with inadequate fluid and fibre intake are at higher risk of experiencing constipation. A similar finding was reported by Yurtdaş *et al.* (2020), who found a correlation between constipation and fibre and water intake.

University students are frequently preoccupied with consecutive lectures and assignments required for their studies, as well as participation in extracurricular events to earn merit for their hostel. The primary challenges experienced by the students to engage in physical activity are time limitation due to the involvement in extracurricular activities, family and work commitments and also the longer time taken to commute to university (Brown *et al.*, 2024). This exhausting daily schedule gives little opportunity for students to participate in exercise or other physical activities as recommended, which contributes to the physical inactivity and a sedentary lifestyle among students, causing students to have an overweight or obese BMI.

BMI has been acknowledged as a significant factor associated with constipation. Recent research has investigated the potential involvement of visceral fat accumulation in the pathophysiology of constipation, given that obesity is increasingly considered a risk factor for gastrointestinal disorders (Guo *et al.*, 2025). For instance, Silveira *et al.*

(2021) reported a significantly higher incidence of constipation among adults with a BMI of 25 to 39.9 kg/m². Therefore, BMI should not be neglected because most university students nowadays do not have a healthy BMI. A previous study conducted among Malaysian university students by Radzi *et al.* (2019) reported that 6.1% of undergraduate students were underweight, 53.4% lay in the normal range, 23.0% were overweight, and 17.6% were obese.

1.2 Problem Statement

Nowadays, the prevalence of constipation keeps rising. It was found that 93.1% of Malaysians were experiencing constipation, which is often associated with having lumpy or hard stools, and 79.3% of them reported having straining while defecating (Jayasimhan *et al.*, 2013). Lim *et al.* (2016) noted that constipation is a common health issue among university students. Despite the growing interest, the prevalence and factors influencing constipation among university students remain limited, particularly in Malaysia. Additionally, there have been limited comprehensive studies examining the link between dietary fibre intake, BMI, lifestyle patterns and constipation.

The consumption of dietary fibre among university students in Malaysia was significantly insufficient, with various studies indicating notable inadequacy compared to recommended levels (Mat Ludin *et al.*, 2024). Low dietary fibre intake is a recognised contributor to constipation, and a previous study indicated that 84.6% of Malaysian adults, including university students, consume dietary fibre significantly less than the recommended 25g per day (Ibrahim *et al.*, 2022). Minimal research explored the link between dietary fibre deficiencies and constipation among Malaysians, particularly university students.

Lifestyle patterns play a significant role in the management and prevention of constipation, as Chang *et al.* (2015) stated that constipation was often linked to various risk factors, particularly diet and lifestyle–related factors. Additionally, the possible contributors to constipation include inadequate fibre and fluid intake, a sedentary lifestyle, and environmental changes (Chang *et al.*, 2015). Most studies examined the components of lifestyle factors, such as fluid intake or exercise, individually rather than assessing them using a scoring system.

Certain populations (e.g., adults and young populations) show that higher BMI increase the likelihood and severity of constipation (Rojas-Rojales *et al.*, 2025). Obesity rates can be reduced by engaging in more physical activity, encouraging healthier eating habits and adopting more independent eating behaviours (Calella *et al.*, 2024). The implementation of nutritious eating habits enables individuals to balance energy intake and energy expenditure, thus helping university students to have a normal BMI to decrease the susceptibility to constipation. However, some studies find no link between BMI and constipation (Toğuç, 2025).

According to Ghosh and Sanyal (2024), students in this age group typically go through a crucial transitional phase. Students enrolling in university often encounter a turning point in their personal and academic development, marking a transition between campus life and their community (Ghosh and Sanyal, 2024). Students might experience distressing life events that lead to negative emotions and behaviour (Marum *et al.*, 2013). Ghosh and Sanyal (2024) also noted that these possible causes can lead to gastrointestinal dysfunction, increasing the likelihood of constipation.

Despite the well-known benefits of dietary fibre in promoting gastrointestinal well-being, many young adults in Malaysia, particularly university students, fail to achieve daily fibre recommendations, which increases the likelihood of constipation. Aside from that, fewer studies focus on the association between BMI and constipation among university students. In addition, the established studies yielded inconsistent results regarding the influence of BMI on constipation. Besides that, this study also examined the association between lifestyle patterns and constipation to thoroughly understand the relationship among university students. Addressing this knowledge gap is crucial because the findings may contribute to the improvement of gastrointestinal health and overall

quality of life among university students, as well as educating them on the management and prevention of constipation.

1.3 Research Question

- Is there any association between dietary fibre intake with constipation among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia (USM), Kelantan?

- Is there any association between body mass index (BMI) with constipation among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia (USM), Kelantan?

- Is there any association between lifestyle patterns with constipation among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia (USM), Kelantan?

1.4 Research Objective

1.4.1 General Objectives:

To determine the association between dietary fibre intake, body mass index (BMI) and lifestyle patterns with constipation among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia (USM), Kelantan.

1.4.2 Specific Objectives:

1. To determine the association between dietary fibre intake and constipation among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia (USM), Kelantan.

2. To determine the association between body mass index (BMI) and constipation among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia (USM), Kelantan.

3. To determine the association between lifestyle patterns and constipation among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia (USM), Kelantan.

1.5 Research Hypothesis

1.5.1 Hypothesis 1:

Null hypothesis (H_o): There is no association between dietary fibre intake and constipation among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia (USM), Kelantan.

Alternative hypothesis (H_A): There is an association between dietary fibre intake and constipation among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia (USM), Kelantan.

1.5.2 Hypothesis 2:

Null hypothesis (H_o): There is no association between body mass index (BMI) with constipation among undergraduate students in the Health Campus of Universiti Sains Malaysia (USM), Kelantan.

Alternative hypothesis (H_A): There is an association between body mass index (BMI) and constipation among undergraduate students in the Health Campus of Universiti Sains Malaysia (USM), Kelantan.

1.5.3   Hypothesis 3:

Null hypothesis (H$_o$): There is no association between lifestyle patterns and constipation among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia (USM), Kelantan.

Alternative hypothesis (H$_A$): There is an association between lifestyle patterns and constipation among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia (USM), Kelantan.

1.6 Significance of the Study

Constipation is a bowel issue that can affect daily functioning and academic performance among university students. Despite its higher prevalence, it often remains insufficiently addressed by this group, as many students are unaware of the seriousness of this condition. This lack of awareness results in poor management and intervention. Therefore, this study assesses the adequacy of daily dietary fibre intake, BMI, and constipation among university students, along with its effects on constipation, aiming to provide valuable information for effective management and prevention. This study further supports existing evidence that increased dietary fibre intake relieves constipation symptoms. Moreover, consistent education about the benefits of dietary fibre consumption can motivate individuals to meet the daily recommended intake outlined in the Recommended Nutrient Intake (RNI) Malaysia 2017. Additionally, this study emphasises the importance of raising awareness about factors contributing to low dietary fibre intake, regardless of sociodemographic background, and implementing targeted approaches in university settings to improve fibre consumption and lifestyle habits,

thereby reducing constipation and enhancing student well-being. Furthermore, understanding the relationship between dietary fibre intake, BMI, and lifestyle patterns with constipation among Malaysian university students will aid in developing targeted interventions.

1.7 Conceptual Framework
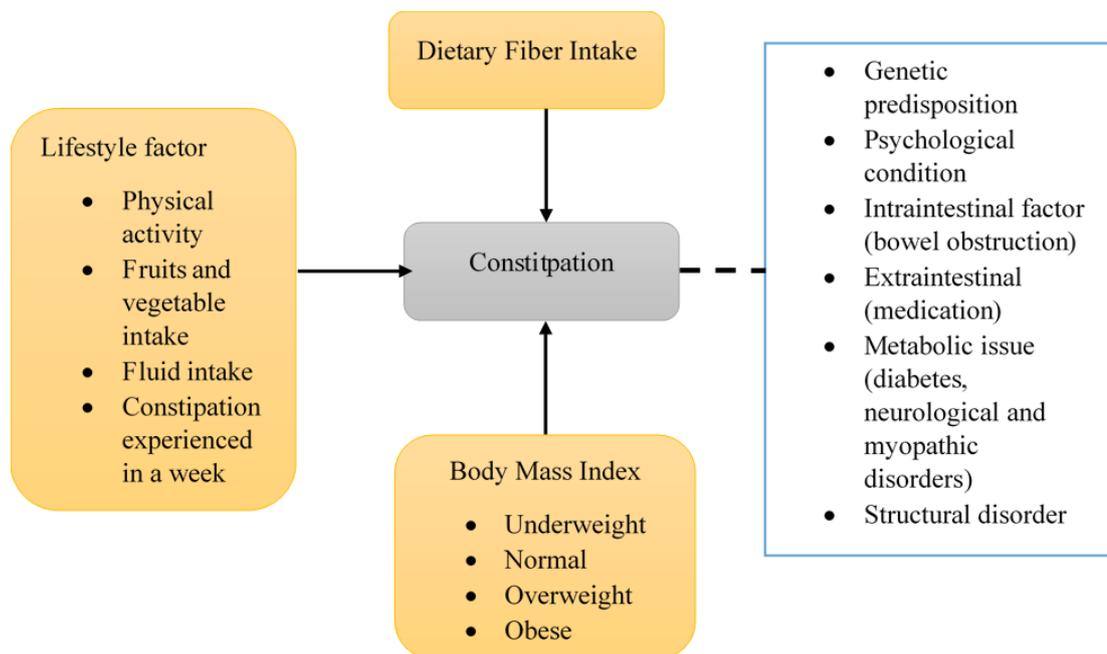
Figure 1: Conceptual Framework

⟶   Included in the study

– – – ·   Not included in the study

This conceptual framework is adapted from Aounallah-Skhiri *et al.* (2011). Constipation among students could be attributed to several factors such as dietary fibre intake, body mass index and lifestyle patterns. However, constipation could also arise from diverse causes such as genetic predisposition, neurological disorders, structural defects, psychological conditions like stress, both extraintestinal (medication) and

intraintestinal factors (bowel obstruction), metabolic issues and structural disorders (Vriesman *et al.*, 2019; Forootan *et al.*, 2018; Milosavljevic *et al.*, 2021; Jani and Marsicano, 2018). However, regardless of many contributing factors associated with constipation, this study sought to investigate the relationship between dietary fibre intake, lifestyle patterns, and body mass index with constipation among undergraduate students in the School of Health Sciences, USM, Kelantan.

Many studies found an important relationship between dietary fibre intake with constipation. For instance, several studies have shown a positive impact of dietary fibre on constipation through its ability to alleviate the symptoms (Rollet *et al.*, 2021; Rojas-Rojales *et al.*, 2025; Macêdo *et al.*, 2020; Sheth and Dey, 2024; Ismail *et al.*, 2022). Some studies also highlighted the impact of dietary fibre inadequacy on constipation, increasing the susceptibility to constipation (Macêdo *et al.*, 2020; Shen *et al.*, 2019; Rollet *et al.*, 2021. According to Ng *et al.* (2016), most undergraduate students consume low dietary fibre, below the recommended intake which becomes a key determinant in the increased risk of constipation development. Besides that, the components of lifestyle patterns were also the key determinants that influenced constipation. Few studies showed the link between physical activity and constipation, and most results showed that both were correlated (Calella *et al.*, 2024; Wilson, 2020). Aside from that, fluid intake and BMI were also one of the contributors to constipation (Karabudak *et al.*, 2019; Chen *et al.*, 2020; Sheth and Dey, 2024; Rojas-Rojales *et al.*, 2025).

CHAPTER 2: LITERATURE REVIEW

2.1 Overview of Constipation

Constipation is characterised by uncomfortable sensations experienced during defecation. Constipation can be described as a condition of altered bowel movements indicated by hard stools, straining during defecation, and a feeling of incomplete evacuation (Sharma and Rao, 2017; Ghosh *et al.*, 2023; Li *et al.*, 2021). Sharma and Rao (2017) included additional features of constipation symptoms, which were the use of digital manoeuvres for stool evacuation and abdominal bloating. Verkuijl *et al.* (2020) found that the youngest age group (19–38 years) exhibited a higher prevalence of constipation (23.5%) compared to other age groups. Supporting this, Besar *et al.* (2022) reported that among 283 fifth-year medical students in Egypt, the overall prevalence of constipation was 26.5%, with notably higher rates among females (41.1%) compared to males (19.1%).

According to Diaz *et al.* (2023), constipation can be classified into primary and secondary subtypes. Functional constipation (FC), or primary constipation, is among the most common functional gastrointestinal disorders (FGIDs) globally and can be subdivided based on underlying mechanisms (Wang and Yao, 2021). It included categories such as normal transit, slow transit constipation, and rectal evacuation disorders (Vriesman *et al.*, 2019). Vriesman *et al.* (2019) suggested that the pathophysiology of functional constipation is multifactorial, with key contributing factors including genetic predispositions, lifestyle choices such as diet and physical activity, and psychological conditions.

Conversely, secondary constipation results from other diseases or conditions that cause constipation. Causes can be intraintestinal, such as bowel obstruction, or

extraintestinal, including medication and lifestyle factors (Milosavljevic *et al.*, 2021). According to Jani and Marsicano (2018), secondary constipation may be resulted from insufficient fluid intake, metabolic issues like diabetes, neurological and myopathic disorders such as scleroderma, as well as structural disorders like strictures and large rectoceles, which were not the focus of the present study.

Constipation can affect quality of life if symptoms persist, impairing well-being by causing mental discomfort, loss of productivity, and financial burdens for those needing further treatment (Ibrahim *et al.*, 2022). It can also lead to social embarrassment and anxiety due to uncomfortable symptoms and reluctance to discuss the condition. It can be supported by the previous findings by Rasche *et al.* (2024), which discovered that both Russian and France cohorts experiencing constipation had high levels of negative feelings, shyness, and reported interruptions to their daily lives and well-being. The psychological discomfort can lead to social activity avoidance and negatively impact overall quality of life (Yurtdaş *et al.*, 2020).

2.2 Dietary Fibre Consumption and Constipation

Most dietary fibres mainly consist of structural polysaccharides that make up the plant cell walls. Plant cell walls are composed of a complex layer of polysaccharides, and understanding their functions is very challenging due to the variety of sources and roles within the cell (Gill *et al.*, 2021). The World Health Organisation (WHO) recommended that adults should consume at least 25 g of dietary fibre daily and 400 g of vegetables and fruits (World Health Organisation, 2023). Therefore, a total dietary fibre intake of <25 g/day is considered low, while ≥25 g/day constitutes a high intake. According to the Malaysia National Health and Morbidity Survey (NHMS) 2023, 95.1% of adults have an insufficient daily intake of fruits and vegetables, as they consume only 2 servings of fruit and/or vegetables per day, which is significantly lower than the advised 5 servings daily (Institute for Public Health, 2024). The Institute for Public Health (2024) reported a rise from 92.5% in 2011 to 94% in 2015, then to 94.9% in 2019, and reaching 95.1% in 2023, which showed the annual increase in the proportion of fruit and vegetable inadequacy. Similarly, a previous study conducted among the Chilean general population reported that 90% of the population consumed less fibre than recommended, with a minimum intake of 25 g/day, and no significant differences were observed across gender, geographical area, or urban/rural residence, reflecting a global trend of inadequacy of fruit and vegetable consumption (Guzmán-Pincheira *et al.*, 2023).

Despite the well-documented benefits of dietary fibre, particularly concerning constipation, the average intake among the population remains below the recommended levels and might be caused by several factors. According to the previous study, factors related to the low intake of fruit and vegetables reported by adults in the urban population of Saudi Arabia were perceptions of high cost, limited health benefits, lack of availability, and dislike of taste (Alfawaz *et al.*, 2020).

Gill *et al.* (2021) emphasised that dietary fibre has a significant relationship with the development and management of numerous diseases and with mortality, supported by extensive epidemiological and interventional studies. The numerous benefits of consuming dietary fibre associated with constipation from various sources have been widely studied and verified by extensive research literature. For example, a few studies reported the strongest link between dietary fibre intake with constipation across all groups, including children, adults, and the elderly (Yusop and Yasin, 2021; Yurtdaş *et al.*, 2020; Ng *et al.*, 2016). Furthermore, dietary fibre alleviated constipation symptoms by enhancing faecal bulk, increasing bowel movement frequency, and decreasing the time for faecal material to pass through the large intestine (Ismail *et al.*, 2022). This aligned with the study by Van Der Schoot *et al.* (2022), who highlighted that high soluble fibre content in fruits and vegetables attracts water, thus facilitating defecation by softening stools, increasing stool passage frequency, and improving overall consistency. Both types of dietary fibre, namely soluble, viscous fibres, and insoluble, non-viscous fibres, contributed to improved stool consistency and increased stool bulk (Gill *et al.*, 2021). Wheat bran and high fibre cereal fractions are commonly recommended to prevent constipation (P and Joye, 2020).

Despite existing studies, the association between dietary fibre intake with constipation is underexplored among university students. Hence, it is very important to investigate its association among university students further to educate them on having adequate dietary fibre intake to reduce the risk of constipation.

2.3 Association Between Body Mass Index (BMI) Classification and Constipation

The Body Mass Index (BMI) classification used by the Centers for Disease Control and Prevention (2024) aligns with the standard classification developed by the World Health Organisation (2010). It categorises individuals as underweight (BMI less than 18.5 kg/m²), normal weight (BMI between 18.5 and 24.9 kg/m²), overweight (BMI between 25.0 and 29.9 kg/m²), or obese (BMI of 30 kg/m² or greater). Obesity is further classified into three classes: Obesity class I indicates BMIs ranging from 30.0 to 34.9 kg/m²; class II from 35.0 to 39.9 kg/m²; and class III for BMIs of 40 kg/m² and above.

Multiple studies have explored the association between BMI and constipation. BMI and constipation symptoms were found to be positively and significantly correlated, suggesting that a higher BMI is linked to more constipation symptoms (Rojas-Rojales *et al.,* 2025). Conversely, Alkhowaiter *et al.* (2021) and Le Pluart *et al.* (2015) reported no significant association between constipation and BMI. The contrasts in the findings might be due to the variations in the tools used to measure constipation or differences in study design. For instance, Rojas-Rojales *et al.* (2025) employed the Rome III version of the International Diagnostic Questionnaire for Paediatric Functional Gastrointestinal Disorders, whereas Alkhowaiter *et al.* (2021) used the Arabic translation of the GI symptoms assessment.

Rather than focusing on each class of BMI, several studies have specifically examined the link between obesity and constipation. For example, research conducted in Goiânia, Brazil, and research conducted in Ankara, Turkey, found a significantly higher prevalence of constipation among obese individuals (Silveira *et al.*, 2021; Yurtdaş *et al.*, 2020). Alsheridah and Akhtar (2018) also noted that obese individuals tend to be more

susceptible to other risk factors for constipation, such as lack of physical activity and an unbalanced diet, which often indicates low consumption of dietary fibres.

Although increasing recognition exists regarding the relationship between BMI and constipation, most available evidence focuses on older adult populations or children. Limited studies have examined how BMI may contribute to constipation among young adults, particularly university students, who are at increased risk for notable dietary and lifestyle changes during their transition to independent living. Additionally, most of these established studies were conducted outside Malaysia. These gaps highlighted the necessity of conducting this study to explore the association between BMI and constipation within the local undergraduate student population.

2.4 Lifestyle Patterns and Constipation

Lifestyle is a modifiable variable that can be used to determine the health and well-being of an individual. In addition, they represented an expression of individual motivations and behaviours (Brivio *et al.*, 2023). It comprises patterns of behaviour, engagement, consumption, work, activity, and interest and defines how people spend their time (Ibrahim *et al.*, 2022). Lifestyle patterns, including physical activity, smoking, and alcohol consumption, can be grouped under the same component instead of emphasising each factor to find its association with health or illness because lifestyle patterns were distinguished as a dynamic interaction between factors (Gherasim *et al.*, 2020).

Previous studies have listed several lifestyle-related risk factors that affect constipation, including dietary fibre consumption, levels of physical activity, fluid intake, and BMI (Yurtdaş *et al.*, 2020). A previous study highlighted the association between physical inactivity and a lack of recreational physical activity with constipation (Wilson, 2020). Consistent with this finding, another study found that active or moderately active people have a lower risk of experiencing constipation (Calella *et al.*, 2024). Similarly, Moezi *et al.* (2018) found that higher physical activity slightly reduced the rate of constipation by approximately 50% in physically active individuals. Consistent with the findings, the management of constipation through physical activity, such as aerobic exercise, exhibited positive outcomes that improved the symptoms of constipation (Gao *et al.*, 2019).

Apart from the physical activity, the frequency of fruit and vegetable intake and fluid intake also influenced the onset of constipation. For example, individuals who consumed more than three spoons of vegetables per day had a lower prevalence of constipation than

those with less fibre intake (Verkuijl *et al.*, 2020). This is because the fibre content in both fruit and vegetables facilitates the defecation process (Van Der Schoot *et al.*, 2022).

Besides that, fluid intake is also recognised as a contributing factor to constipation. However, findings from different studies on the connections between constipation with dietary fluids have yielded inconsistent results. Ismail *et al.* (2022) noted that sufficient fluid intake reduced the possibility of being constipated and facilitated the dietary fibre in increasing the stool weight and softening the stools. Contrary to this finding, several studies found a negative correlation between fluid intake and constipation (Khatri *et al.*, 2011; Yusop and Yasin, 2021).

Limited studies have explored the lifestyle pattern by combining it under the same component to assess its association with constipation. Hence, the present research addresses this gap by combining these lifestyle modification factors, which included exercise in a week (physical activity), fluid intake daily, weekly intake of fruits and vegetables and constipation experience in a week to identify their links with constipation through the scoring system, which categorised them into healthy and moderate lifestyles.

CHAPTER 3: METHODOLOGY

3.1 Research Design

This study was conducted by using a cross-sectional study among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia (USM), Kelantan, to determine the association between dietary fibre intake, BMI and lifestyle patterns with constipation among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia (USM), Kelantan. The cross-sectional design was a type of observational study design that involved looking at data from a population at one specific point in time. In other words, the investigators need to measure the outcomes and exposures of the study subjects at the same time (Wang and Cheng, 2020).

3.2 Study Area

The study was conducted at Universiti Sains Malaysia, Kubang Kerian, Kelantan. It focused only on undergraduate students from the School of Health Sciences. This location was selected due to its accessibility and the ease of reaching the respondents. Furthermore, the study area was limited, allowing a better understanding of the study conducted on undergraduate students at Universiti Sains Malaysia.

3.3 Study Population

The target population of this study was undergraduate students in the School of Health Sciences, aged under 25 years old. The range of age chosen in this study was between 19 – 25 years old because it aligned with the standard age of university enrolment. Next, this study excluded international students. International students were excluded as they might have different eating behaviours that might influence dietary fibre intake and lifestyle patterns compared to local students. Moreover, international students often

experience dietary acculturation or simply describe it as a process of adaptation to local food culture while preserving their original food culture upon their arrival in the foreign country (Shi *et al.*, 2020).

3.4 Subject Criteria

3.4.1 Inclusion criteria

- Undergraduate students in the School of Health Sciences, Universiti Sains Malaysia, Kelantan.
- Age between 19 - 25 years old.

3.4.2 Exclusion criteria

- International students.

3.5 Sample Size Estimation

The sample size is calculated using a proportion calculation to estimate the required sample size. The formula for the two-proportion formula is shown below:

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

n = sample size

p_1 = prevalence of constipation in the first population

p_2 = prevalence of constipation in the second population

z_α = level of statistical significance

z_β = corresponding to the power of the study

Objective 1:

To determine the association between dietary fibre intake and constipation among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia (USM), Kelantan.

z_α is set to be 1.96, which corresponds to the 95% level of significance, while $z\beta$ is set at 0.84, which corresponds to a power of 80%. According to the study by Ibrahim *et al.* (2022), p_1 is set as 0.667, which corresponds to the percentage of 66.7% coming from participants who consume <25 g/day of dietary fibre and have constipation. p_2 is set as 0.333, which corresponds to the percentage of 33.3% coming from participants who consume ≥25 g/day of dietary fibre and have constipation.

$$n = \frac{0.667(1 - 0.667) + 0.333(1 - 0.333)}{(0.667 - 0.333)^2}(1.96 + 0.84)^2$$

$$= 31 \, people$$

The non-responsive rate should be considered. The selected percentage of non-responsive rate is 10%.

$$n = \frac{0.667(1 - 0.667) + 0.333(1 - 0.333)}{(0.667 - 0.333)^2}(1.96 + 0.84)^2 + 10\%$$

$$= 34 \, people$$

Objective 2:

To determine the association between body mass index (BMI) and constipation among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia (USM), Kelantan.

- normal vs overweight

z_α is set to be 1.96, which corresponds to the 95% level of significance, while $z\beta$ is set at 0.84, which corresponds to a power of 80%. According to the study by Yurtdaş *et al.* (2020), p_1 is set as 0.494, corresponding to 49.4% of individuals who are normal with constipation, while p_2 is set as 0.317, which corresponds to 31.7% of individuals who are overweight with constipation.

$$n = \frac{0.494(1 - 0.494) + 0.317(1 - 0.317)}{(0.494 - 0.317)^2}(1.96 + 0.84)^2$$

$$= 116\ people$$

The non-responsive rate should be considered. The selected percentage of non-responsive rate is 10%.

$$n = \frac{0.494(1 - 0.494) + 0.317(1 - 0.317)}{(0.494 - 0.317)^2}(1.96 + 0.84)^2 + 10\%$$

$$= 129\ people$$

- normal vs obese

z_α is set to be 1.96, which corresponds to the 95% level of significance, while $z\beta$ is set at 0.84, which corresponds to a power of 80%. According to the study by Yurtdaş *et al.* (2020), p_1 is set as 0.494, corresponding to 49.4% of individuals who are normal with constipation, while p_2 is set as 0.189, which corresponds to 18.9% of individuals who are obese with constipation.

$$n = \frac{0.494(1 - 0.494) + 0.189(1 - 0.189)}{(0.494 - 0.189)^2}(1.96 + 0.84)^2$$

$$= 34\ people$$

The non-responsive rate should be considered. The selected percentage of non-responsive rate is 10%.

$$n = \frac{0.494(1 - 0.494) + 0.189(1 - 0.189)}{(0.494 - 0.189)^2}(1.96 + 0.84)^2 + 10\%$$

$$= 38 \, people$$

- Overweight vs obese

z_α is set to be 1.96, which corresponds to the 95% level of significance, while $z\beta$ is set at 0.84, which corresponds to a power of 80%. According to the study by Yurtdaş *et al.* (2020), p_1 is set as 0.317, corresponding to 31.7% of individuals who are normal with constipation, while p_2 is set as 0.189, which corresponds to 18.9% of individuals who are obese with constipation.

$$n = \frac{0.317(1 - 0.317) + 0.189(1 - 0.189)}{(0.317 - 0.189)^2}(1.96 + 0.84)^2$$

$$= 177 \, people$$

The non-responsive rate should be considered. The selected percentage of non-responsive rate is 10%.

$$n = \frac{0.317(1 - 0.317) + 0.18.9(1 - 0.189)}{(0.317 - 0.189)^2}(1.96 + 0.84)^2 + 10\%$$

$$= 197 \, people$$

Objectives 3:

To determine the association between lifestyle patterns and constipation among undergraduate students in the School of Health Sciences, Universiti Sains Malaysia (USM), Kelantan.

z_α is set to be 1.96, which corresponds to the 95% level of significance, while $z\beta$ is set at 0.84, which corresponds to a power of 80%. According to the study by Nisa (2020), p_1 is set as 0.674, corresponding to 67.4% of individuals who do not do physical activity and

have constipation, while p_2 is set as 0.326, which corresponds to 32.6% of individuals who do not do physical activity and have constipation.

$$n = \frac{0.674(1 - 0.674) + 0.326(1 - 0.326)}{(0.674 - 0.326)^2}(1.96 + 0.84)^2$$

$$= 28 \, people$$

The non-responsive rate should be considered. The selected percentage of non-responsive rate is 10%.

$$n = \frac{0.674(1-0.674)+0.326(1-0.326)}{(0.674-0.326)^2}(1.96 + 0.84)^2 + 10\%$$

$$= 31 \, people$$

In this study, the sample size selected was 197 people. However, the targeted sample size could not be achieved, as the total participants in this study was only 163 due to time constraints.

3.6 Sampling Method and Subject Recruitment

The samples of this study were obtained through convenience sampling. Convenience sampling is a non-probability sampling method in which the data were collected from a readily accessible and available group of individuals (Simkus, 2023). The convenience sampling method required less effort from the researcher in selecting or finding the respondents, did not consume too much time and was a cost-effective option since the sample was taken from a readily accessible population (Golzar *et al.*, 2022).

The subject recruitment was carried out by blasting the poster containing details such as research-related information among undergraduate students using online platforms. Respondents who met the inclusion criteria were eligible to join this study. Before that,