

**THE ASSOCIATION BETWEEN BODY MASS INDEX (BMI)
STATUS AND DIETARY INTAKE PATTERN WITH MENSTRUAL
IRREGULARITIES OF UNDERGRADUATE STUDENTS IN
SCHOOL OF HEALTH SCIENCES, UNIVERSITI SAINS
MALAYSIA (USM)**

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**SCHOOL OF HEALTH SCIENCES
UNIVERSITI SAINS MALAYSIA**

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MALAYSIA (USM)**

By

NORAISHAH BINTI SUS Aidin

Dissertation submitted in partial fulfilment of the requirements for the
degree of

Bachelor of Health Science (Honours)(Dietetics)

July 2024

CERTIFICATE

This is to certify that the dissertation entitled “THE ASSOCIATION BETWEEN BODY MASS INDEX (BMI) STATUS AND DIETARY INTAKE PATTERN WITH MENSTRUAL IRREGULARITIES OF UNDERGRADUATE STUDENT IN SCHOOL OF HEALTH SCIENCES, UNIVERSITY SAINS MALAYSIA (USM)” during the period from **October 2023** to **July 2024** under my supervision. I have read this dissertation and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation to be submitted in partial fulfilment 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 investigation, 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 purpose.

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LIST OF ABBREVIATION

BMI	Body Mass Index
CPG	Clinical Practice Guidelines
FFQ	Food Frequency Questionnaires
SPSS	Statistical Package for Social Science Software
USM	Universiti Sains Malaysia
RNI	Recommended Nutrient Intake
WHO	World Health Organization
HPG	hypothalamus-pituitary-gonadal
LH	Luteinizing hormone
FSH	Follicle-stimulating hormone
HREC	Human Research Ethics Committee USM
CI	Confidence Interval
SHBG	Sex hormone-binding globulin
FAI	Free androgen index

**HUBUNGKAIT ANTARA STATUS INDEKS JISIM BADAN DAN CORAK
PENGAMBILAN MAKANAN DENGAN KITARAN HAID TIDAK TERATUR
DALAM KALANGAN PELAJAR SARJANA MUDA DI PUSAT PENGAJIAN
SAINS KESIHATAN, UNIVERSITI SAINS MALAYSIA (USM)**

ABSTRAK

Kajian ini bertujuan untuk mengenalpasti hubung kait antara status indeks jisim badan dan corak pengambilan makanan dengan masalah kitaran haid yang tidak teratur dalam kalangan pelajar sarjana muda di Pusat Pengajian Sains Kesihatan, USM. Sejumlah 179 pelajar sarjana muda berumur antara 19 hingga 25 tahun daripada semua program yang ditawarkan di kampus kesihatan terlibat dalam kajian ini. Kajian ini telah dijalankan dengan menggunakan reka bentuk keratan rentas dan kaedah persampelan rawak mudah. Data untuk kajian ini telah diperolehi melalui satu set soal selidik secara atas talian untuk mengumpulkan maklumat sosio demografik, antropometrik, corak pengambilan pemakanan dan kitaran haid. Berat dan tinggi bagi setiap peserta dalam kajian ini telah diukur menggunakan penimbang dan stadiometer sebelum mereka mula menjawab satu set soal selidik. Maklumat pemakanan subjek dikumpul menggunakan Soal Selidik Kekerapan Makanan yang diadaptasi daripada lima kajian lepas. Hasil kajian menunjukkan bahawa 62% subjek dengan majoriti berumur 22 tahun merekodkan mengalami masalah kitaran haid yang tidak teratur dan selebihnya 38% merekodkan mengalami kitaran haid yang teratur. Kajian ini mendapati pelajar yang mengalami masalah kitaran haid yang tidak teratur kerap mengambil minuman beralkohol (n=1), minuman berkafein (60.6%) dan makanan ringan (59.4%). Tambahan pula, pelajar yang mengalami masalah ini juga tidak kerap mengambil sayur-sayuran (62%), buah-buahan (60.7%) dan produk tenusu (61.8%). Selain itu, kajian ini juga tidak mendapati perkaitan yang signifikan antara status

indeks jisim badan dan corak pengambilan makanan dengan masalah kitaran haid yang tidak teratur dalam kalangan pelajar sarjana muda sains kesihatan di Universiti Sains Malaysia Kampus Kesihatan. Oleh itu, kajian lanjutan diperlukan untuk mendapatkan gambaran yang lebih jelas tentang perkaitan antara status indeks jisim badan dan corak pengambilan makanan dengan masalah kitaran haid yang tidak teratur.

**ASSOCIATION OF BODY MASS INDEX (BMI) STATUS AND DIETARY
INTAKE PATTERN WITH MENSTRUAL IRREGULARITIES OF
UNDERGRADUATE STUDENT IN SCHOOL OF HEALTH SCIENCES,
UNIVERSITI SAINS MALAYSIA (USM)**

ABSTRACT

This study aimed to identify the association between body mass index (BMI) status and dietary intake patterns with irregular menstrual cycle among undergraduate students in School of Health Sciences, USM. A total of 179 undergraduate students aged between 19 and 25 years from all programs available in Health Campus were involved in this study. The study was conducted using a cross-sectional design and used convenience random sampling method. The data for this study was obtained through a set of online questionnaires to collect socio-demographic, anthropometric, dietary intake patterns and menstrual cycle information. The weight and height of each participant in this study were measured using a scale and stadiometer before they started to answer a set of questionnaires. The dietary information of the subjects was collected using the Food Frequency Questionnaire (FFQ) which adapted from five previous studies. The results of the study showed that 62% of the subjects with majority were 22 years old recorded having irregular menstrual cycles and the remaining 38% recorded having regular menstrual cycles. The study found that students with irregular menstrual cycles frequently consumed alcoholic beverages (n=1), caffeinated beverages (60.6%) and snacks (59.4%). In addition, students with these problems also ate less vegetables (62%), fruits (60.7%) and dairy products (61.8%). In addition, the study also did not find a significant association between weight status and dietary intake patterns with irregular menstrual cycle problems among undergraduate students in School of Health Science, Universiti Sains Malaysia. Therefore, further studies are

needed to get a clearer picture of the link between body mass index (BMI) status and dietary intake patterns with irregular menstrual cycle problems.

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Menstruation, or period, is normal vaginal bleeding that occurs as part of a woman's monthly cycle. The duration of menstrual cycle is calculated from the first day of bleeding to the beginning of the next bleed. Woman's menstrual cycle is considered normal if it lasts between 21 and 35 days (Dovom *et al.*, 2016). If the cycle is shorter or longer than this range, bleeding is heavier or lighter than usual, or there are other issues such as cramping in the abdomen, these are considered menstrual irregularities (Whitaker & Critchley, 2016). In addition, irregular menstruation can be either anovulatory, meaning that ovulation does not occur, or ovulatory, meaning that ovulation occurs. Amenorrhea, oligomenorrhea, menorrhagia, prolonged menstrual bleeding, dysmenorrhea, polymenorrhagia, less than two days of menstrual bleeding, and intermenstrual bleeding are the most common irregularities associated with menstruation (Patel *et al.*, 2022). According to Helfiana (2020) irregular menstruation can be defined as a process of hormonal imbalance in the female reproductive system, which requires the presence of the hormones estrogen and progesterone in the correct composition.

According to Sreelakshmi *et al.* (2019), out of 225 undergraduate female students who participated in the study, 97 students (38%) have irregular menstrual cycles, 192 students (75%) have premenstrual syndrome and 146 students (57%) have dysmenorrhea. A study carried out in selected Malaysian universities (Samat *et al.*, 2020) reported that 52.7% of students suffered from dysmenorrhea, 15.6% from menorrhagia and 10.2% from oligomenorrhea. Another study in Ethiopia involving

620 students at Debre Berhan Universiti showed that 202 (32.6%) students had irregular menstruation (Zeru, Gebeyaw & Ayele, 2021). Siti-Arffah et al. (2019) conducted a study among 422 female students in Selangor, revealed that 333 (78.9%) students had irregular menstrual cycles. These studies indicated that menstrual irregularities is common among school age and higher learning institutions, thus it is of utmost important to determine the factor contributing to the problem as it may affect the quality of life, especially the academic performance of students (Demeke et al., 2023).

Numerous studies have shown that certain lifestyle factors can lead to irregular menstruation (Chauhan *et al.*, 2021). Since it has a significant impact on menstrual irregularities, lifestyle factors such as weight, stress, anaemia, and alcohol consumption need to be controlled (Zeru, Gebeyaw & Ayele, 2021). Mena et al. (2021) found that women with irregular cycles were more likely to be obese (27.6%) than participants who were underweight (22.8%), overweight (17.6%), or normal weight (17.6%). Additionally, previous study also found that women who regularly eating junk food (70.37%) and practicing unhealthy diet (79.20%) are more likely to have menstrual irregularities (Negi, Mishra & Lakhera, 2018). Therefore, it is imperative to confirm these findings in this study to determine the potential influence of weight status and dietary intake on menstrual health, specifically focusing on university students.

1.2 Problem Statements & Study rationale

Menstrual irregularities disorders have become a major problem for adolescent girls. According to Chauhan et al. (2021), 75% of adolescent girls have problems with menstruation. Obesity, skipping breakfast, consuming junk food, lack of physical activity, and stress have also been linked to menstrual problems (Akhila, Shaik & Kumar, 2020). According to Shafia et al. (2020), menstrual irregularities appear to be increasing among young Indian girls due to lifestyle changes such as eating junk food regularly. It seems that the factor that can cause menstrual irregularities needs to be identified in order to reduce the disease.

Shafia et al. (2020) reported that menstrual irregularities gradually increase with increasing BMI value. A higher percentage of menstrual irregularities were reported in overweight (16%) and obese girls (42.9%). Chauhan et al. (2021) reported that the prevalence of overweight/obese women with menstrual problems is 16.1% which is more than normal weight (13.4%). This indicates that healthy dietary intake is crucial to achieve a normal BMI becomes essential for women with menstrual problems. According to Bajalan, Alimoradi & Moafi (2019), the consumption of many vitamins and minerals from vegetables and fruit, fish, milk and dairy products can give benefits in menstrual pain. It suggests that insufficient nutritional status in the body can alter hormone levels due to decreased energy levels, while dysmenorrhea is triggered by an imbalance in prostaglandin hormones. Fujiwara (2018), has documented that 60% of college students engage in diet control, while 40% undergo diet restriction. It has been observed that there is a higher incidence of menstrual irregularities among these individuals, which may be attributed to dietary limitations or inadequate nutrition, potentially inducing ovarian dysfunction.

In this study, the association between weight status and dietary intake with

menstrual irregularities has been assessed among undergraduate students in School of Health Sciences, Universiti Sains Malaysia (USM). The prevalence of menstrual irregularities among university students has been a growing concern in recent years. This phenomenon appears to be associated with various factors including weight status and dietary intake. However, the nature and extent of these associations remain unclear, warranting a comprehensive investigation. Understanding the relationship between body mass index (BMI) status, dietary intake, and menstrual irregularity among university students is crucial for promoting women's health and well-being during their academic years and beyond.

Based on previous studies, students may be knowledgeable about menstrual cycles, and some may have experienced problems such as irregular periods or bleeding during menstruation (Rathod *et al.*, 2023). Menstrual irregularities can cause discomfort or pain, prevent students from attending classes, and affect their quality of life. Weight status and dietary intake were two factors that influenced this disorder. Most women entering college life have given little thought to the importance of a factor that can affect their reproductive health. The findings from this study will provide evidence on the prevalence of irregular menstruation and could improve understanding on the risk factors or causes of irregular menstruation, primarily weight and dietary intake status.

Students are more likely to eat unhealthy diets, such as junk food, because they have less time for healthy eating and are more likely to be stressed, buy high-calorie convenience foods, or have easy access to junk food (Sogari *et al.*, 2018). According to Chalise (2018), many student consumed junk food for at least three times per week (84.8%) and one time within 24 hour (68.7%). Additionally, Eng et al. (2022),found that low-cost housing communities have unhealthy dietary patterns which low

consumption of fruits and vegetables but high intake of processed food and beverages and high intake of high calorie food. An unhealthy diet has been identified as one of the factors contributing to adverse effects on weight status, leading to both high and low BMI values. A high BMI contributes to an increased risk of developing several diseases. According to the Khanna et al. (2022), BMI is the appropriate measure for early detection of obesity and its associated health risks except for person with large amounts of muscle mass, such as athletes. Therefore, it is important to measure the BMI and dietary intake of the female students in this study as it may indicate health risks.

This study holds paramount significance as it delves into the intricate relationship between weight status, dietary intake, and menstrual irregularity among university students. The findings not only contribute crucial insights into the potential health risks associated with menstrual irregularities but also bear implications for academic performance and quality of life among female students. The study outcomes can inform targeted public health interventions promoting healthier lifestyles and reproductive well-being among this demographic. Moreover, the research aids in the development of gender-specific health promotion strategies, fostering increased awareness and informed decision-making. Ultimately, this investigation addresses a critical gap in understanding the modifiable factors influencing menstrual health in university settings, providing a foundation for comprehensive initiatives that benefit the overall health and empowerment of young women.

1.3 Research Questions(s)

- i) What is the body mass index (BMI) status of undergraduate students in School of Health Sciences, USM?
- ii) What is the dietary intake pattern of undergraduate students in School of Health Sciences, USM ?
- iii) What is the prevalence of menstrual irregularities of undergraduate students in School of Health Sciences, USM ?
- iv) Is there any association between body mass index (BMI) status and dietary intake pattern with menstrual irregularities of undergraduate students in School of Health Sciences, USM ?

1.4 Research Hypothesis

Null Hypothesis (H₀)

H₀ : There is no significant association between body mass index (BMI) status with menstrual irregularities of undergraduate students in School of Health Sciences, USM.

Alternative Hypothesis (H_A)

H_A : There is significant association between body mass index (BMI) status with menstrual irregularities of undergraduate students in School of Health Sciences, USM.

Null Hypothesis (H₀)

H₀ : There is no significant association dietary intake pattern with menstrual irregularities of undergraduate students in School of Health Sciences, USM.

Alternative Hypothesis (H_A)

H_A: There is significant association between dietary intake pattern with menstrual irregularities of undergraduate students in School of Health Sciences, USM.

1.5 Research Objective

General:

To investigate the association between body mass index (BMI) status and dietary intake with menstrual irregularities of undergraduate students in School of Health Sciences, USM.

Specific:

- i) To determine the body mass index (BMI) status of undergraduate students in School of Health Sciences, USM.
- ii) To determine the dietary intake pattern of undergraduate students in School of Health Sciences, USM.
- iii) To determine prevalence of the menstrual irregularities of undergraduate students in School of Health Sciences, USM.
- iv) To determine the association between body mass index (BMI) status and dietary intake pattern with menstrual irregularities of undergraduate students in School of Health Sciences, USM.

1.6 Conceptual Framework

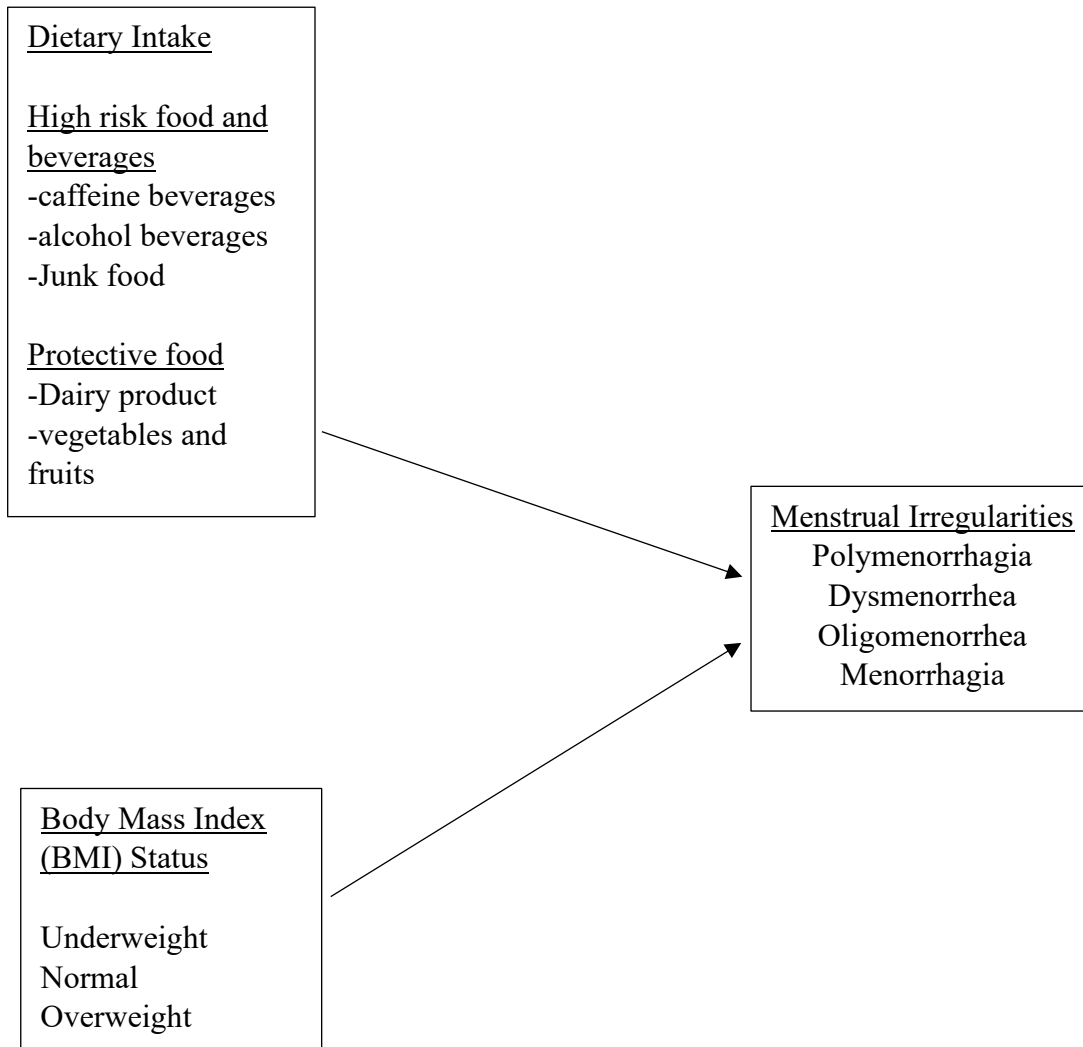


Figure 1: Conceptual framework for the association between weight status and physical activity with menstrual irregularities among undergraduate student

As shown in Figure 1, Undergraduate students from the School of Health Sciences at USM were participated in this study. Sociodemographic factors include age, ethnicity, year of study and programme of study. The study's independent variables included dietary intake, body mass index status, and sociodemographic profile. One of the dependent variables is irregular menstruation. Underweight, normal weight, overweight and obesity were among the weight status variables. Dietary intake

variables included two categories which is high risk food and beverages (junk food, alcohol and caffeine beverages) and protective food (vegetables, fruits and dairy). This study examined the associations between weight status and dietary intake with menstrual irregularities among undergraduate students in the School of Health Science at Universiti Sains Malaysia.

CHAPTER 2

LITERATURE REVIEW

2.1 Body mass index (BMI) status among young female adults

According to Alhazmi et al. (2021) body mass index (BMI) is an indicator to determine weight status (underweight, normal, overweight and obese). One study from Wy et al. (2011) which involve 584 university students found 22.4% of females were underweight, 12.3% were overweight or obese. This shows that female students are more likely to be underweight. Although there were more underweight (22.4%) female university students, it was first noted that females were more likely to have abdominal obesity. Another study carried out in the Philippines also found that there were more underweight females (56.6%) (Toledano & Vilela, 2023).

According to Midthjell et al.(2013),the incidence of BMI-defined overweight grew from 29.9% in 1984-1986 to 37.7% in 2006-2008, while the frequency of obesity class I increased from 10.1% in 1984-1986 to 16.6% in 2006-2008 among adult females. According to a study by Hashan et al. (2020), the youngest age group (15-24 years) had the highest frequency of underweight females (26%) while the middle age group (25-34 years) had the lowest frequency (2.5%). The oldest age group (35-49 years) had the highest frequency (82.6%) of overweight and obesity, while the adolescent female (15-24 years) had the lowest frequency (36.7%). In addition, this study found that females with secondary education had the highest frequency (15.5%) of underweight status, while frequency of overweight and obesity increased as educational level decreased, with the highest proportion (82.9%) among females with only primary education. Underweight was more common in single females (38.4%) than in married females (20.1%) and females who were separated, divorced, or

widowed (22.6%). Married females (75.4%) had a higher prevalence of overweight and obesity than single females (32.6%) and females who were separated, divorced, or widowed (70.1%). This demonstrates the tendency for adult females to be underweight, is more prevalent in single and secondary educated females.

2.2 Dietary intake pattern among young female adults

According to the Malaysian recommended nutrient intake (RNI,2017), an adult should consume 50%-65% of carbohydrates, 25%-30% of fat, 10%-20% of protein and 20g-30g of dietary fiber per day (Ministry of Health, 2017). Healthy diet can be defined as a pattern of dietary intake that has beneficial effects on health or at least no harmful effects(de Ridder et al., 2017).

According to study that have been conducted among female adult aged 18-25 years old with BMI more than 25kg/m², it was found that 25% of participants consumed less than 1 serve of dairy product per day, 64% consumed less than 1 serve of fruit, and only 32% of the young women consumed less than half the recommended serves of vegetables. This indicate that obese or overweight female tend to consume unhealthy diet (Young et al., 2023). In addition, adult with low-cost housing communities tend to have unhealthy dietary patterns with low intake of fruits and vegetables and high intake of ultra-processed foods and calorie dense foods, with highest among the Malay (90.5%), followed by Indian (89.7%), and Chinese (85.2%). Ultra-processed food includes commercially baked goods such as cookies and pastries, packaged snack foods such as chips and fast food such as McDonalds. It also states that the adequate intake of vegetables and fruits should be 5 serving per day according to WHO recommendations (Eng *et al.*, 2022).

According to Young et al. (2023) state that 80% of participants with age 18-25 years old reported consumption of junk food at least once per week, while 20% reported consume multiple time per week. Consume junk food make decrease intake of healthy food. According to Mandoura et al. (2017) it has found that female tend to consume junk food (87.4%) than male (85.6%) which it is influence by many factors such as emotional and education. It also states that major contributor in increase fast food consumption is convenience and easy availability while hanging out with friend and family. Junk food is high in calorie, sugar, harmful fats and inadequate in essential nutrients which can lead to nutrient deficiencies.

According to White (2020) have found that female collages student is more likely to consume alcohol beverages (61%) than non-collage student (51%) due to academic stress and other. Although men collages are more likely to consume higher intake of alcohol than female collages, but women tend to experience greater harms than men when consume lower levels of alcohol.

2.3 Irregular menstrual cycle among young females adults

Irregular menstrual cycle is defined as changes occurring in regularity of onset, frequency of onset, duration of flow and volume from regular menstrual cycle (Demeke et al., 2023). The regularity of female menstrual cycles is one indicator of reproductive health. Menstrual irregularity is most common among females under the age of 23, but it can also occur at any age (Mittiku *et al.*, 2022). It was reported that menstrual irregularity is widespread, with rates of 35.7% in India (Kumar, Seshadri & Murthy, 2018). It also has widespread in Nepal (64.2%) (Sharma, Deuja & Saha, 2016). In the study, by Mittiku et al. (2022) state that in Sudan, the prevalence of

menstrual irregularity is 55%, while in Ethiopia it ranges from 26.5% to 32.6%. In study conducted at IIUM Kuantan Campus among 245 female undergraduate students found majority 65.3% of the students having menstrual cycle that shorter than 26 days, 63.3% less than 31 days, 57.6% not missing or having long breaks between periods, 61.2% have irregular bleeding or having short breaks between periods, 78% have heavy bleeding after 3 to 4 days and 74.3% have light bleeding for the whole period time (Zainul Azlan, Bustaman & Abdul Razak, 2022).

The data was collected in the study also using the systematic random sampling technique from June to July 2021. The study involved the participation of 395 female college students. The findings revealed that 132 (33.4%) of the participants had an irregular menstrual cycle which among these participants, 77 (58%) experienced irregular onset, while 16 (12.12%) reported heavy bleeding during menstruation. It was also found that students under the age of 20 were 3.88 times more likely to experience irregular menstrual cycles compared to those aged 25 years and above. According to Rigon et al. (2012) it was found that among the participants, 34% had polymenorrhagia and 51% had oligomenorrhea. The study also observed a prevalence trend of irregularities in young female adults aged 18 years and above. The prevalence decreased from 6% at 18 years old to 5% at 19 years old but increased to 8% at 20 years old and above.

The common type of irregular menstrual happen in female adult such as polymenorrhagia, dysmenorrhea, oligomenorrhea, and menorrhagia (Mishra, Vijay & Tiwari, 2023). Polymenorrhagia is refer to menstrual cycle less than 21 days (Rad, Torkmannejad Sabzevary & Mohebbi Dehnavi, 2018). Dysmenorrhea is referred to several menstrual cramps and pain which occur before or during menstruation, oligomenorrhea is refer to infrequent, irregular menstruation with longer-than-normal

gaps between periods and menorrhagia is refer to abnormally heavy or prolonged menstrual bleeding which often with blood clots (Mishra, Vijay & Tiwari, 2023). Patel et al. (2022) recorded that 70.97% of participant had oligomenorrhoea, 8.87% had polymenorrhagia, 16.93% had menorrhagia/menometrorrhagia, and 3.22% had hypomenorrhoea. In addition, a cross-sectional study involving 798 young girls in the age group of 18 to 24 years found that among 705 respondents, 211 females (29.30%) experienced irregular menstruation, and 340 girls (47.02%) out of 723 reported painful menstruation. In this study, it also shows the pattern of dysmenorrhoea, which 313 (39.22%) suffered from backache, 240 (30.08%) experienced abdominal pain/cramps, 265 girls (33.21%) complained of leg pain, 349 girls (51.25%) reported irritation, 139 (20.41%) experienced a lack of concentration during menstruation, 119 (17.47%) felt depressed, and 166 (62.17%) had premenstrual discomfort in the form of breast pain, migraines, and nausea. This can impact the quality of life for females, especially students. In this study, it was found that 209 (85.65%) students miss college every month, with 136 (40.71%) being absent for the entire day, 132 (39.52%) being absent for half a day, and 66 (19.76%) leaving college for more than a day (Ritesh Gujarathi et al., 2014). In addition, 843 out of 1867 females aged 18 years and above reported having missed days of work due to their menstrual cycle in the previous 12 months. It also states that the majority of the respondents reported a moderate to severe negative impact on their concentration at work (77.2%), energy levels (89.3%), efficiency (68.3%), interest in their own work (71.6%), mood (86.9%), and relationship with colleagues (39.0%) due to their menstrual cycle. In this study, it is also stated that the condition may occur due to certain symptoms, with the most common being cramps (91%), fatigue (85%), and bloating (81%) (Ponzo *et al.*, 2022). Therefore, menstrual

health is important for females as it can have a significant negative impact on their quality of life.

2.4 Impact of body mass index (BMI) status and dietary intake on menstrual irregularities among young female adults

Menstrual irregularities are a type of menstrual disorder. A study from Dhar et al. (2023) has shown that an increased BMI can contribute to the risk of developing menstrual disorders. The menstrual cycle is regulated by the hypothalamus-pituitary-gonadal (HPG) axis. Luteinizing hormone (LH) and follicle-stimulating hormone (FSH) are secreted when the hypothalamus secretes gonadotropin-releasing hormone (GnRH). LH and FSH stimulate the ovaries in females to produce estrogen and progesterone (Le, Thomas & Gurvich, 2020). Obese women tend to experience alterations in the typical levels of steroid hormones, such as estrogen, which can lead to disturbances in the menstrual cycle and issues like irregular periods (Mena, Mielke & Brown, 2021). Increased estrogen causes a decrease in GnRH through negative feedback (Dağ & Dilbaz, 2015).

A study conducted by Dars et al.(2014) found that female adolescents with a BMI of 25-29.9 kg/m² experienced infrequent menstrual cycles, while those with a BMI of 24-24.9 kg/m² had a normal menstrual pattern. Another study by Shafia (2020) aimed to assess the menstrual patterns and weight status among 560 college girls in South India, and the study recorded that 18.9% of the total participants were overweight, and 2.5% were obese. It was also found that menstrual irregularities gradually increased as BMI values increased. Besides, a higher percentage of menstrual irregularities was recorded in overweight girls (16%) and obese girls (42.9%). In addition, it was found that obesity (BMI > 30) was more common among women with dysmenorrhea (Samat et al., 2020). Furthermore, a cross-sectional study

conducted among 210 adolescent school girls in Delhi revealed that 114 (54.3%) had a BMI below 18.5. The study also found that menstrual irregularities were more prevalent in girls with a BMI <18.5 (5.6%) compared to those with a normal BMI (2.4%) (Singh, Rajoura & Honnakamble, 2019). This indicates that females who are underweight, overweight, or obese are more likely to experience menstrual irregularities compared to females of a healthy weight.

Besides, many study also have shown dietary intake can influence menstrual cycle which there is certain food and beverages that is contribute to high risk to develop menstrual irregularities and there is type of food can prevent from having menstrual irregularities. According to (Negi, Mishra & Lakhera, 2018) it has found that female with dysmenorrhea were more frequently eat junk food (66.10%) and unhealthy diet (72.88%). Furthermore, it also indicated that junk food contains high levels of saturated fatty acids, which can have an impact on the progesterone metabolism during the menstrual cycle and it also deficient in essential micronutrients, which could potentially contribute to the onset of dysmenorrhea and menstrual irregularities. According to Mahmoud et al. (2014), it has found that consumption of caffeine beverages lead to menstrual abnormalities, mainly prolonged and heavy menses, and oligomenorrhoea among female which it is due to caffeine was expected can reduce uterine blood flow, and shorten the duration of menstrual cycle and caffeine also can inhibits the action of adenosine, which affects luteinizing hormone and follicle-stimulating hormone that can reduce the length of the menstrual cycle. According to Ding et al. (2019), it has found that prevalence of heavy menstrual bleeding is higher among female consume regular intake of alcohol with the prevalence is 34.5% which more than never consume alcohol (15.5%). This is due to the intake of alcohol can elevate levels of testosterone, estradiol, and luteinizing hormone in premenopausal

women and lead to hormonal imbalance which contribute to have heavy menstrual bleeding.

According to (Ciołek *et al.*, 2023) menstrual pain was less recorded in female which consuming an anti-inflammatory diet which is low in processed products such as vegetables, fruit, and dairy. According to (Abdul-Razzak *et al.*, 2010) it was found that dysmenorrhea was lower in female which consume of dairy product three to four servings a day than female doesn't consume daily dairy product and there is no recorded of female having menstrual pain when the consumption of dairy product was increased to four serving per day. It states that this is due to 70% of dietary calcium comes from dairy products such as cow's milk, egg, and cheese which can provide protective effect against menstrual pain. Consumption of fresh or cooked vegetables more than once per day was reported lower in dysmenorrhea participant (33.7%) than consume it only once per day (69.2%) and consumption of fruit more than one pieces has reported less of dysmenorrhea (28.6%) than consumption of fruit juices daily (58.6%) (Onieva-Zafra *et al.*, 2020). According to (Swetha N B, 2021) it was found that, only 23 out of 79 female consume green vegetables daily have irregular menstrual cycle, only 32 out of 52 female consume one serving of fibre rich vegetables daily have menstrual irregularities and among four female consume two serving of vegetables daily have no record of menstrual irregularities. This study indicate that frequent intake of green vegetables can prevent menstrual irregularities.

CHAPTER 3

METHODOLOGY

3.1 Research Design

A cross-sectional study was carried out to determine the association between weight status and dietary intake with menstrual irregularity among undergraduate students from the School of Health Sciences, Universiti Sains Malaysia, Kubang Kerian, Kelantan.

3.2 Study Area

The study has been take place at the School of Health Sciences, in Health Campus, Universiti Sains Malaysia, Kubang Kerian, Kelantan. This location is being chosen because individuals in the School of Health Science, Universiti Sains Malaysia (USM) have different backgrounds such as age, course of study, and ethnicity.

3.3 Study Population

The population have been chosen for complete this study involves undergraduate student in School of Health Science, Universiti Sains Malaysia (USM) Health Campus, Kubang Kerian, Kelantan in the academic session of 2023/2024 that have fulfill the requirement criteria for this study. This study was involved undergraduate student from Year 1 until Year 4 which includes all courses that are available in School of Health Science, Universiti Sains Malaysia (USM) Health Campus, Kubang Kerian, Kelantan. This study was not include undergraduate students from Medical school and Dental school due to both school have different timetable such as different in class and exam time which make it become difficult to collect the data at same time and time-consuming. According to Qamar (2023), he states that, it

was difficult to dental and medical student to dedicate time for research activities due to time constraints, clinical rotations, coursework, academic obligations, and other commitments. This indicates that both dental and medical student have busy timetable which make difficult for them to give cooperation in this study and lead to have lower amount of participant from both school. The total number of female undergraduate students in School of Health Sciences are 954 students were obtained from the administration office of the School of Health Sciences.

3.4 Subject Criteria

This study involve participant based on the following inclusion and exclusion criteria:

The inclusion criteria are:

- i. Undergraduate student from School of Health Sciences in Universiti Sains Malaysia (USM) Health Campus, Kubang Kerian, Kelantan for academic session 2023/2024.
- ii. Age ranges from 19-25 years.
- iii. Voluntarily agree to participate in the study.

The exclusion criteria are:

- i. Undergraduate students from School of Medical Sciences and School of Dental Sciences in Universiti Sains Malaysia (USM) Health Campus, Kubang Kerian, Kelantan for academic session 2023/2024.
- ii. Undergraduate student that that undergoing industrial training outside the campus.
- iii. Student that was pregnant and breastfeeding.

3.5 Sample size estimation

3.5.1 Sample Size Calculation for Specific Objective

There is a many research on the association between body mass index (BMI) status and dietary intake with menstrual irregularities among undergraduate student. Therefore, the sample size was determine based on finding title “Study on the Menstruation Pattern and Weight Status of College Girls in Chennai, South India”. Based on the result, the prevalence of menstrual irregularities among young adult college students is 10.9% (Shafia, 2020).

$n = \frac{Z^2 p(1-p)}{d^2}$	<p>n = sample size</p> <p>Z = statistic corresponding to confidence level</p> <p>p = expected prevalence</p> <p>d = precision (true value)</p>
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Sample size, $n = \frac{1.96^2 (0.109)(1-0.109)}{0.05^2}$

$$0.05^2$$

$$= 149.2 \approx 149$$

Drop-out rate, 20% is considered

Sample size, $n = 149 + 20\%$ drop out rate

$$= 178.8 \approx 179$$

Based on calculation, the sample size for this study is 179.

There is many research on the prevalence of body mass index (BMI) among undergraduate students which most of it found the higher prevalence of obese students have menstrual irregularities. The prevalence of obese students was 0.7% was determined based on finding title “Are Menstrual Patterns Associated with the Body Mass Index of University Students? A Descriptive Study in Mangalore, Karnataka, India” (Banu *et al.*, 2023)

$$\text{Sample size, } n = \frac{1.96^2 (0.007)(1-0.007)}{0.05^2}$$

$$0.05^2$$

$$= 10.7 \approx 11$$

Drop-out rate, 20% is considered

Sample size, $n = 11 + 20\%$ drop out rate

$$= 13.2 \approx 13$$

There is lack of research on the dietary intake pattern among undergraduate student. Therefore, the sample size was determine based on finding title “Relationship Of Menstrual Cycle With Dietary Pattern Among Adolescents And Young Adults In Urban Area Of Kancheepuram District”. Based on the result, there was only one result of frequent intake of dietary pattern which is sweetened soft drink. The prevalence of frequent dietary intake among young adult college students is 0.5% (Swetha N B, 2021).

$$\text{Sample size, } n = \frac{1.96^2 (0.005)(1-0.005)}{0.05^2}$$

$$0.05^2$$

$$= 7.64 \approx 8$$

Drop-out rate, 20% is considered

Sample size, $n = 8 + 20\%$ drop out rate

$$= 9.6 \approx 10$$

Therefore, the total sample size used in this study was 179.

3.6 Sampling method and subject recruitment

A convenience sampling method were used to recruit undergraduate students at the School of Health Science, Universiti Sains Malaysia (USM), Kubang Kerian, Kelantan in this study. According to Golzar & Tajik (2022), convenience sampling method is non-probability sampling method which select participants from the target population based on ease of access. It state that this sampling method doesn't need to prepare list of population, low cost, and consume less effort to select participant. All participant must voluntarily recruit and following inclusion criteria for this study.

3.7 Research tool

In this study, the data on weight and height were obtained through the use of stadiometers and weight scales to determine weight status as well as a set of questionnaires were used to measure dietary intake and menstrual cycle. The questionnaire has been verified. The questionnaires are composed of three parts: Sections A, B, and C. The participants' sociodemographic profile is included in section A. Participants were measured by sections B and C for their dietary intake as well as their menstrual cycle.

Section A: Socio-Demographic Information

Information regarding age, ethnicity, religion, study programs, and years of education was collected in this section. Since the researcher does not require personal information from participants such as names, matric numbers, and telephone numbers due to their private and confidential nature, the online questionnaires in this study were anonymous. The information gathered were used to interpret the results of the study and evaluate them.

Section B: Dietary Intake

To measure dietary intake of each participant, the Food Frequency Questionnaire (FFQ) were used in this section. It consist of food based on five previous study. The questionnaire is classified into 2 section which is high risk food and protection food. In high risk food section, it consist of 3 categories of food and beverages which is junk food, caffeine beverages and alcohol beverages while in protective food section, it also consist of 3 categories which is fruits, vegetables and dairy product. The items were developed to measure the frequency intake of certain food which can influence menstrual health.

Section C: Menstrual Cycle

The questionnaire from the previous Malaysian study Samat et al. (2020) were used. This is a closed questionnaire which needs permission from the author before using it in research. The questionnaire consists of two parts, the menstrual cycle and how it affects quality of life. For this study, the menstrual cycle part was selected. It is composed of eight items that include menstrual cycle length, menstrual cycle duration, amount of menstrual flow, and pain related to menstruation. The scoring of menstrual irregularities is done by directly asking the characteristics of menstrual irregularities experience based on last 3 month.

Weight and height of each participants have been assessed by the researcher using weight scale and stadiometer. The result of weight status or also known as Body Mass Index (BMI) were calculated by researcher using formula and were categorized accordingly. According to CPG obesity (2023), BMI less than 18.5 is consider as underweight, BMI 18.5 to < 22.9, is consider as healthy weight (normal), BMI 23.0 until 27.4, is consider as overweight or pre-obese, BMI 27.5 until 32.4 is consider as obese class I, BMI 32.5 until 37.4 is consider as obese class II, and BMI ≥ 37.5 is consider as obese class III. The result were recorded in SPSS.

3.8 Operational definition

Body mass index (BMI)

Body mass index (BMI) known as tool to determine to the amount of body fat by using height and weight. According to Budzyński et al. (2022) this value serves as indicator of person nutritional status. BMI can be categorized into normal, underweight, overweight and obese.

Dietary Intake Pattern

Dietary intake is a daily eating patterns of an individual which include consumption of certain foods, calories and it's quantities. According to (Shim, Oh & Kim, 2014) there are several dietary assessments methods to measure individual dietary intake which is 24-hour dietary recall (24HR), dietary record (DR), dietary history, and FFQ. It also states that the data can be collected with the help of a trained interviewer or by self-report. Each type of dietary assessment method has limitations and strength. For example, FFQ strength is able to collect complex information and highly accurate data while its limitations are the measurement errors associated with the chosen methodology persist. The dietary intake pattern were classified as frequent if students recorded of daily