ASSOCIATION OF SLEEP QUALITY AND OBESITY AMONG UNDERGRADUATE STUDENTS IN THE SCHOOL OF HEALTH SCIENCES IN USMKK

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2024

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by

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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 “ASSOCIATION OF SLEEP QUALITY AND OBESITY AMONG UNDERGRADUATE STUDENTS IN THE SCHOOL OF HEALTH SCIENCES IN USMKK” is the authentic record of research work done by Ms. Siti Maizatul Raihanah Binti Nor Halim during the period from March 2024 to August 2024 under my supervision. I have read this dissertation and, 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 fulfillment for the degree of Bachelor of Health Science (Honours) (Dietetics).

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 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.

ACKNOWLEDGEMENTS

Alhamdulillah, by the name of Allah the Almighty, the Most Compassionate, the Most Merciful and Most Gracious, the One and Only, for giving me the physical and mental ability to complete this thesis in the allotted time. May the Almighty's divine light shine on my path as I endeavor to acknowledge Him in all aspects of my life.

Apart from my efforts, the success of this journey depends largely on my supervisor, Prof. Madya Ts. Dr. Shariza Abdul Razak, I offer my appreciation for their guidance and insight during this learning process, which greatly assisted me with completing my thesis. I have not forgotten the support I received from my friends, which was vital for the success of this journey.

Lastly, as we save the best for last, I am grateful to my backbones and loves of my life, my parents and family, whose love and prayers are always with me in every moment, and without whom I would not be as ambitious or motivated. They are my unwavering supporters and inspiration in every way.

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HUBUNGKAIT KUALITI TIDUR DAN OBESITI DALAM KALANGAN PELAJAR IJAZAH SARJANA MUDA PUSAT PENGAJIAN SAINS KESIHATAN DI USMKK

ABSTRAK

Kajian ini bertujuan untuk menyelidik hubungan antara kualiti tidur dan obesiti dalam kalangan pelajar ijazah sarjana muda pelajar Pusat Pengajian Sains Kesihatan di USMKK. Satu kajian rentas yang melibatkan 128 orang pelajar ijazah sarjana muda telah dijalankan menggunakan kaedah persampelan mudah. Satu soal selidik dalam bentuk Google Forms telah diedarkan kepada pelajar, yang merangkumi maklumat sosio-demografi, data antropometri dan Pittsburgh Sleep Quality Index (PSQI). Penilaian antropometri telah dijalankan sebelum responden menjawab soal selidik. Daripada jumlah 128 responden, 88.3% pelajar mempunyai kualiti tidur yang lemah. Kajian ini juga mendapati 30.5% pelajar mengalami obesiti berdasarkan indeks jisim badan (obes I, obes II). Selain itu, didapati 21.9% pelajar mempunyai nilai lilitan pinggang yang lebih tinggi, manakala 26.6% mempunyai nisbah pinggang-ke-tinggi yang lebih tinggi. Berdasarkan objektif kajian, perkaitan kualiti tidur dan obesiti berdasarkan indeks jisim badan telah diuji menggunakan ujian Khi Kuasa Dua Pearson, manakala perkaitan kualiti tidur dan obesiti berdasarkan lilitan pinggang dan nisbah pinggang-ke-tinggi diuji menggunakan ujian Fisher's Exact. Malangnya, tiada kaitan yang signifikan secara statistik antara kualiti tidur dan obesiti berdasarkan BMI, WC, dan WHtR. Kesimpulannya, kualiti tidur yang kurang baik adalah masalah utama dalam kalangan pelajar, dan ini boleh membawa kepada risiko pertambahan berat badan dan obesiti yang lebih tinggi. Oleh itu, strategi dan kesedaran yang berkesan diperlukan untuk meningkatkan kualiti tidur dan mengatasi obesiti dalam kalangan pelajar universiti.

ASSOCIATION OF SLEEP QUALITY AND OBESITY AMONG UNDERGRADUATE STUDENTS IN THE SCHOOL OF HEALTH SCIENCES USMKK

ABSTRACT

This study aimed to determine the association of sleep quality and obesity among undergraduate students in the School of Health Sciences at USMKK. A cross-sectional study involving 128 undergraduate students was conducted using the convenience sampling method. An online questionnaire in the form of Google Forms was distributed to the respondents, which included socio-demographic characteristics, anthropometry data, and the Pittsburgh Sleep Quality Index (PSQI). The anthropometry assessment was conducted before respondents answered the questionnaire. Of the 128 respondents, 88.3% of students had poor sleep quality. This study also found that 30.5% of students were obese based on body mass index (obese I, obese II). Also, it was found that 21.9% of students had higher waist circumference values, while 26.6% had higher waist-to-height ratios. Based on the study's objective, the association of sleep quality and obesity based on body mass index was tested using Pearson's Chi-Square test, while the association of sleep quality and obesity based on waist circumference and waist-to-height ratio was tested using Fisher's Exact test. Unfortunately, there was no statistically significant association between sleep quality and obesity based on BMI, WC, and WHtR. In conclusion, poor sleep quality is a major problem among students, and this can lead to a higher risk of weight gain and obesity. Thus, effective strategies and awareness were needed to improve university students' sleep quality and combat obesity.

CHAPTER 1: INTRODUCTION

1.1 Background of Study

Adequate sleep is imperative for maintaining optimal health. According to the NationalInstitute of Health, sleep is a crucial component of the human daily regimen and is indispensable for survival, comparable to the significance of food and water (Buysse & St, 2014). There is a significant correlation between the restoration of sleep and improved physical, cognitive, and psychological well-being. On the other hand, a relationship exists between inadequate sleep and the decline of cognitive and psychological functioning, as well as the deterioration of physical well-being (Brand & Kirov, 2011). Approximately 70% of adults in the United States experience poor sleep quality monthly, while sleep-related issues impact a substantial population of 50–70 million individuals (Nelson et al., 2022). Insufficient sleep can caused by a variety of factors, including physical, psychological, environmental, and behavioural influences.

In recent decades, there has been a significant increase in the occurrence of overweightand obesity, which has become a substantial public health concern on a global scale. According to the World Health Organisation (WHO), in 2016, the number of overweight adults aged 18 years and older exceeded 1.9 billion, with over 650 million adults classified as obese. This corresponds to a prevalence rate of 39% among adults aged 18 years and older who are classified as overweight. In 2016, the global prevalence of obesity among adults was approximately 13% (WHO, 2016). Based on the National Health and Morbidity Survey Malaysia (NHMS), the prevalence of obesity among Malaysian adults continued to increase from 2011 until 2015. The prevalence of overweight among adults in Malaysia was 29.4% in 2011 and 30.0% in 2015, while obesity prevalence was 15.1% and 17.7% respectively (Mohamad Nor et al., 2018).

1.2 Problem Statement & Study Rationale

A substantial body of observational research suggests that insufficient sleep and sleep of poor quality may be global risk factors for obesity. According to national surveys, the adultUnited States population has a high prevalence (37%) of both insufficient sleep (defined as lessthan 7 hours of nighttime sleep on work or weekdays) and obesity (Blumfield et al., 2018). A recent study conducted regarding the sleep patterns of university students in Hong Kong portrays that 57.5% of the participants exhibited poor sleep quality (Sun et al., 2016). In Malaysia, approximately 70.6% of undergraduate students at local universities have poor sleepquality, with the majority (35.5%) being older than 21 years old and 55.3% being female (Azliet al., 2023). According to a previous study, three out of every five undergraduate health sciences students in Kuala Lumpur had poor sleep quality (Ong, Azman & Ho, 2023). This phenomenon may be linked to alterations in metabolism and obesity-related behavior, which gives rise to the question of whether inadequate sleep duration constitutes a risk factor for obesity (Cao et al., 2015).

Since 1975, the global obesity prevalence has nearly tripled. In 2016, approximately more than 1,9 billion overweight adults worldwide, with over 650 million clinically obese (Lemamsha et al., 2019). Based on the latest data in the World Obesity Atlas 2023, adult and child obesity rates in Malaysia are projected to increase at an exceptionally rapid rate each yearover the next few years. The report predicts that adult obesity will rise by 4.7% annually from 2020 to 2035, whereas child obesity rates will increase by 5.3% annually during the same timeframe (Lobstein et al., 2023). Obesity increases have a negative impact on nearly all physiological functions of the body and pose a significant public health threat. It raises the risk of developing a variety of diseases, including diabetes, cardiovascular disease, several types of cancer, a variety of musculoskeletal disorders, and poor mental health. All these factors may have an impact on one's quality of life, work productivity, and, of course, healthcare (Chooi et

al., 2019). Therefore, this study aims to determine the association between sleep quality andobesity among undergraduate students in the School of Health Sciences in USMKK.

1.3 Research Questions

1. What is the sleep quality status among undergraduate students in the School of HealthSciences in USMKK?
2. What is the prevalence of obesity among undergraduate students in the School of Health Sciences in USMKK?
3. Is there any association between sleep quality and obesity among undergraduate students in the School of Health Sciences in USMKK?

1.4 Research Objective

1.4.1 General Objective

To determine the association between sleep quality and obesity among undergraduate students in the School of Health Sciences in USMKK.

1.4.2 Specific Objective

1. To identify sleep quality status among undergraduate students in the School of Health Sciences at USMKK.
2. To identify the prevalence of obesity among undergraduate students in the School of Health Sciences at USMKK.
3. To identify the association between sleep quality and obesity among undergraduate students in the School of Health Sciences in USMKK.

1.5 Research Hypothesis

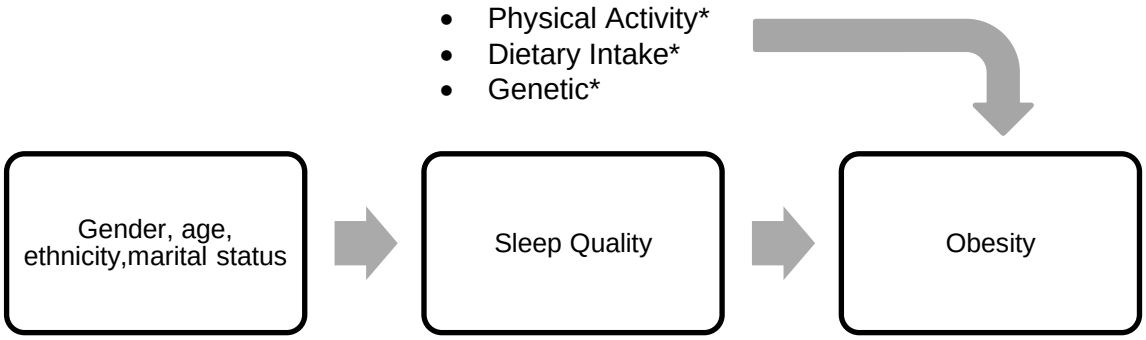
Null Hypothesis (H0): There is no association between sleep quality and obesity among undergraduate students in the School of Health Sciencesin USMKK.

Alternative Hypothesis (H1): There is an association between sleep quality and obesity among undergraduate students in the School of Health Sciencesin USMKK.

1.6 Significance of Research

This study was conducted to determine the correlation between sleep quality and obesity amongundergraduate students in the School of Health Sciences at Universiti Sains Malaysia KubangKerian. Many previous studies have been conducted among students using the well-established Pittsburgh Sleep Quality Index (PSQI) to identify sleep quality and its results suggest that poorsleep quality is particularly common among university students, with between 30% and 70% classified as poor sleepers (Schmickler et al., 2023). Some studies related to sleep quality foundthat low sleep quality is significantly associated with obesity and also emphasized that there is a significant relationship between poor sleep quality and high body mass index (Öztürk & Yabancı Ayhan, 2018). Despite the considerable amount of research dedicated to sleep obesity,there remains a lack of studies that specifically examine obesity in the Asian population usingthe body mass index (BMI) classification. Furthermore, most existing studies continue to evaluate obesity solely based on BMI. Much research indicates that waist circumference is a more reliable indicator of obesity-related diseases. This is attributed to waist circumference's greater predictive value for future health risks, its simplicity of measurement, and its accessibility to the general population (Y. Wang & Beydoun, 2007). Therefore, this study was to assess the relationship between sleep quality and obesity based on BMI, waist circumference, and waist-to-height ratio specifically for the Asian population. Findings from this study may help to raise awareness about the importance of sleep quality in preventing obesity and some diseases.

1.7 Conceptual Framework



*Factors that have not been involved in this study

Figure 1: Conceptual framework

A variety of factors, such as age, gender, ethnicity, marital status, dietary intake, physical activity, and sleep quality significantly influence the development of obesity (Jan Mohamed et al., 2015; Antza et al., 2021). Due to the significant association between age and obesity, the risk of developing a disease is significantly higher among the elderly than among the young. This may occur because of alterations in behavior, such as a shift towards less structured mealtimes altered eating patterns, reduced physical activity, or a slower metabolism (Lemamsha et al., 2019).

In terms of gender, women have significantly higher risks of being overweight or obesethan men. According to the WHO, the prevalence of obesity among women is rising worldwide.One South African study identified two factors associated with female obesity. First, being nutritionally deprived as children, and second, having a higher socioeconomic status (Varì et al., 2016). Among ethnic groups, Malays and Indians were found to have a higher risk for overweight and obesity in comparison to the Chinese or other ethnic groups. A previous studyin Singapore found a higher prevalence of

obesity in ethnic Malays and Indians due to frequently reported practicing unhealthy eating habits, including consumption of sugar-sweetened beverages and deep-fried foods compared to other ethnic groups (Park et al., 2020).

Many previous studies have investigated marital status and obesity, with most of the findings indicating that married people are more likely to be obese than unmarried people. According to one Korean study, married people consume more calories and engage in less physical activity than unmarried people. Marriage increases the frequency of regular meals and late-night snacks, as well as the opportunity to eat together, which increases total energy intake (Lee et al., 2020). Obesity is also linked to dietary intake. The availability of cheap, convenient,calorically dense food has significantly contributed to the rise in obesity (Smith & Smith, 2016).

In terms of sleep quality, poor sleep quality may be associated with being obese. Inadequate sleep is linked to hormonal changes in the body, which may reduce tissue insulin sensitivity. As a result, these changes have an impact on inappropriate food selection, energy regulation changes, excessive food intake, and decreased physical activity (Sejbuk et al., 2022).

CHAPTER 2: LITERATURE REVIEW

2.1 Method for Assessing Sleep Quality

Sleep quality can be measured objectively as well as subjectively. Objective methods, such as polysomnography (PSG), can provide highly reliable information on sleep parameters. Despite being the gold standard for diagnosing multiple sleep disorders, it has several limitations, including the fact that it is not readily available to most clinicians in their daily routine, is expensive, time-consuming, and impractical for epidemiological or research studies (Gerstenslager & Slowik, 2023).

Therefore, several self-questionnaires have been created to assess the factorial structureand psychometric properties of these questionnaires regarding sleep quality, as well as to compare their measurement properties. A systematic literature search was conducted utilizingthe electronic databases PubMed and Scopus from January 2008 to June 2020. Out of the 5,734articles that were discovered, only 49 underwent analysis. The following psychometric instruments and factor structures were examined and reported: Epworth Sleepiness Scale (ESS), Pittsburgh Sleep Quality Index (PSQI), Athens Insomnia Scale (AIS), and Insomnia Severity Index (ISI); Mini-Sleep Questionnaire (MSQ); Jenkins Sleep Scale (JSS); Leeds Sleep Evaluation Questionnaire (LSEQ); and SLEEP-50 Questionnaire. The PSQI is the most utilizedsubjective measure of sleep quality, according to research, due to its high internal consistencyand validity. The usefulness of the total score in identifying good and poor sleepers has been brought into question by the discovery of distinct factorial structures for other methods. For instance, LSEQ and SLEEP-50 appeared to be less applicable for epidemiological and researchsettings due to the lengthy questionnaires and their scoring (Fabbri et al., 2021).

The PSQI was widely utilized not only for quantifying sleep quality but also for establishing convergent validity in numerous studies that validate sleep questionnaires, indicating that it can be regarded as an accepted reference or gold standard for self-perceived sleep quality. The primary objective behind the development of the Pittsburgh

Sleep Quality Index was to establish a standardized, valid, and dependable metric for assessing sleep quality. Secondly, to differentiate "good" sleepers versus "poor" sleepers. Thirdly, to create an index that is straightforward to utilize for both subjects and clinicians and researchers to interpret, aswell as to provide a concise and clinically valuable evaluation of diverse sleep disruptions thatcould potentially impact sleep quality. Thus, due to PSQI's simplicity and its ability to identifydifferent groups of patients, it is suggested to be used in a variety of clinical and research settingsin psychiatry and general medical fields. It may also be useful in determining the relationship between sleep quality and other factors, such as age, gender, health status, and medical and psychiatric conditions (Buysse et al., 1989).

2.2 Factors Influencing Sleep Quality

Sleep is an intrinsic and reversible state that is controlled primarily by neurobiological processes. It is a vital physiological component of human existence that is critical for the preservation of overall health and wellness. The quality of sleep is influenced by many factors, such as physical activity, caffeine intake, stress, and smartphone addiction. According to one study, three groups were included: young (21-29 years), middle-aged (36-64 years), and elderly(65-81 years). From this study, it was found that the elderly who engaged in more physical activity scored lower on the PSQI, indicating better sleep quality. This demonstrates that physical activity may improve sleep quality (Sejbuk et al., 2022). Following that, caffeine consumption may impair sleep quality. An interruption in sleep can occur, in part, due to the reduction in the principal metabolite of melatonin (6-sulfatoxymelatonin) that occurs the night after caffeine consumption during the day. Laboratory research indicates that a one-night nocturnal sleep deficiency of even 90 minutes can result in a one-third decrease in daytime alertness (O'callaghan et al., 2018).

Stress also has the potential to impact both the quality of sleep and the degree of daytimesleepiness. A research investigation involving 166 college students who were registered for 15-week Pilates, Taijiquan, or GYROKENESIS courses during the 2007-2008 academic year revealed that perceived stress played a substantial mediating role in the association between heightened mindfulness and enhanced sleep quality (Caldwell et al., 2010). Perceived stress may impact the quality of sleep among students due to several reasons. Perceived stress may impact the quality of sleep among students for various reasons. For instance, the demands of college life, such as final exams and erratic schedules, can act as precipitating factors that contribute to stress-related sleeping difficulties. Additionally, students may lack adequate coping mechanisms to manage stressful situations, leading to increased internalizing thoughts,ruminating, and anxiety (Lund et al., 2010).

Beyond that, it is observed that individuals demonstrating elevated levels of smartphoneaddiction are prone to experiencing disrupted sleep patterns and elevated psychological distress (Nikolic et al., 2023). Smartphone addiction is correlated with the practice of using one's device before bedtime and immediately following awakening. A cross-sectional study involving 224 medical students enrolled in a tertiary care teaching hospital in North India revealed that increased daily smartphone usage leads to addiction, which negatively impacts the quality of sleep. This is because an addiction to smartphones results in increased smartphone usage during the night, which negatively impacts the quality of sleep (Chatterjee & Kar, 2021).

2.3 Prevalence of Obesity

There is a concerning surge in the incidence of obesity across both developed and developing nations globally. India is classified as a developing nation undergoing a period of transition characterized by poverty-induced malnutrition and obesity precipitated by rapid urbanization and industrialization. More than 135 million individuals are reportedly affected by obesity in India (Ahirwar & Mondal, 2019). Growth in urbanization andmodernization have been identified as significant factors in the increase in the prevalence of obesity in European nations. They comprised two-thirds of the world's obese nations in 2013. They comprised as much as 83.3% of all European nations dealing with the issue, which is more than half of the nations in the world (55.6%) (Krzysztoszek et al., 2019).

Furthermore, in 2013-2014, a cohort study at the Southeast Asia Community Observatory (SEACO) in Segamat District, Johor, gathered approximately 40,000 people, 5475 of whom were aged 16-35. Malay, Chinese, Indian, and Indigenous (Orang Asli) families makeup the population. According to the findings of the study, the prevalence of obesity was 7.9% and 20.9% at the same ages. The prevalence of obesity among participants aged 16 to 35 underscores the importance of this life stage in terms of BMI trends. The concurrent rise in national wealth, urbanization, and industrialization has been used to explain Malaysia's rising obesity prevalence. (Pell et al., 2016).

The increasing global prevalence of obesity contributes to a rise in the clinical burden.While obesity may not have a direct impact on morbidity and mortality, it does elevate the likelihood of developing numerous chronic illnesses. Plus, obesity also raises the burden on the weight-bearing joint, resulting in impaired ability to move, which is the primary reason forreduced physical activity that ultimately contributes to higher rates of illness and death (Mohd-Sidik et al., 2021).

2.4 Ways of Assessing Obesity

Various methods are used in the diagnosis and evaluation of obesity to determine the amount of fat distribution of body fat. These methods differ in terms of their practicality, costs, and degree of accuracy. Anthropometric measurements (BMI, skinfold measurement, waist, and hip circumference measurement) are the most used due to their low cost and ease of application (Tokaç Er et al., 2021). The scientific community's current acceptance of BMI represents its emergence as a readily available measure of health at the onset of an increased health crisis. It is also a useful clinical and epidemiological metric for determining and monitoring the prevalence of obesity (Gutin, 2018). However, the disadvantage of relying solely on BMI is that muscular patients may have a relatively high BMI but low-fat mass, and in the elderly, BMI may underestimate fat mass due to a decrease in lean body mass (Ness- Abramof & Apovian, 2008). Thus, it is suggested that BMI and waist circumference be used to predict a better outcome for obesity. Furthermore, BMI and waist circumference are well-validated measurements that are available to all health professionals.

The amount of fat tissue in the body is just as important as where it is distributed. Hence,waist circumference and waist/hip ratio are important in determining obesity risk. Waist circumference was initially developed as a simpler and potentially better indicator of health risk than BMI. Furthermore, it is one of the best anthropometric predictors of visceral fat and one of the best indicators of total body fat as BMI or skinfold measurement. People who haveexcess abdominal fat wasting large muscle groups, or both, have a large waist circumference relative to their hip circumference (high waist-to-hip ratio). However, waist circumference alone predicts visceral and total fat as well as disease risks better than the waist-to-hip ratio (Han et al., 2006).

Skinfold thickness is measured to determine body density and thus percentage of bodyfat because skinfold thicknesses at specific sites have a reasonable correlation with the percentage of body fat. However, because of differences in the distribution of

subcutaneous fat between individuals, multiple sites must be sampled to obtain accurate results. Thus, it is not recommended that the estimation of percentage body fat from skinfold measurements be used because the results may vary, it is necessary to have good skills to use this method, and many predictive equations that incorporate various skinfold measures with other factors such as age, gender, and ethnicity have been developed (Mattsson & Thomas, 2006).

2.5 Types of Obesity

Obesity is the abnormal or uneven buildup of adipose tissue, which can hurt a person's overall health. We can classify obesity into two categories general obesity and abdominal obesity. General obesity is usually classified by BMI alone. It is calculated as bodyweight in kilograms divided by the height in meters squared (kg/m^2) (Engin, 2017). Meanwhile,abdominal obesity, also known as central obesity, is characterized by the accumulation of adipose tissue in the abdominal region (Dhawan & Sharma, 2020). In general, abdominal obesity is typically assessed through the utilization of computed tomography and magnetic resonance imaging to measure abdominal fat. However, in clinical environments, waist circumference is employed as an approximation due to the significant correlation between waist circumference and intra-abdominal fat (Yang et al., 2022). Therefore, it can be concluded that dependable indicator of abdominal obesity. Abdominal obesity is determined by an individual's body mass index (BMI) and is assessed by an elevated waist circumference, which is defined as 90 cm or greater for men and 80 cm or greater for women (CPGs Obesity, 2023).

2.6 Factors Contributing to Obesity

Obesity has been linked to an increase in the occurrence of cardiovascular diseases, conditions, and problems, as well as rising mortality rates. Understanding the common causesof obesity is therefore critical because it will allow the development of approaches and even policies to help curb this global epidemic (Safaei et al., 2021). A few influencing factors determine obesity, for instance, lack of physical activity (PA), excessive calorie consumption, and sleep quality.

A cross-sectional survey of adults aged 18 and up was conducted in Malaysia. This study looked at the levels and patterns of PA in normal-weight and overweight/obese adults and discovered a link between PA levels. According to the findings, 51.2% of adults were obese (BMI 25), even though nearly 70% of subjects reported at least a moderate level of PA. This finding indicates that most of the participants met the WHO's minimum levelof total PA but were still obese. This study also found that obese adultswere less likely than normal-weight adults to engage in vigorous-intensity physical activity. Thus, physical activity was found to be inversely related to the risk of being obese (Chan et al., 2017).

Present health guidelines for managing obesity are founded upon the fundamental physiological principle that fat accumulation results from an imbalance in energy levels between calories consumed and calories expended. The increased availability of energy-dense and gratifying foods has fueled a substantial portion of this obesity epidemic. A 13-yearfollow-up study involving 3000 adults aged 18-30 revealed that individuals with significantlyhigher fast-food consumption had an average increase in weight of 6 kg and a larger waist circumference compared to those with the lowest fast-food intake. The higher concentrations of total calories, fat, cholesterol, and refined carbohydrates found in fast food are associated with increased weight gain and weight loss (Duffey et al., 2007).

In addition, sleep quality may contribute to obesity through various potential pathways. Such as inadequate sleep quality resulting from a brief duration of sleep. The reduction in sleep duration caused by late sleep timing may result in physiological alterations in hunger and appetite. Potential effects of sleep timing on obesity include a disruption in eating pattern timing. In contrast to individuals who adhere to earlier sleep schedules, those who adhere to later sleep schedules exhibit a higher tendency to skip breakfastand snack after dinner (Ogilvie & Patel, 2017). The link between insufficient sleep and obesityappears to be related to an impact on energy consumption. People who sleep for a short periodhave more awake hours available, which will likely result in a positive energy balance. Another rimportant link between insufficient sleep and increased energy intake is the effect of insufficient sleep on brain activity in response to food cues, which can reduce cognitive controland activity in cortisol brain regions, resulting in the selection of foods most likely to cause weight gain (Antza et al., 2021).

2.7 Implications of Obesity

Globally, obesity is a growing health concern. It is correlated with an elevated risk of cardiovascular disease and various other related medical conditions, including hypertension and diabetes. An association exists between obesity and coronary atherosclerosis. A study of 3000 individuals aged 15 to 34 who died of external causes and were autopsied in forensic laboratories revealed that atherosclerosis develops decades before the onset of coronary arterydisease symptoms. According to the findings of this research, atherosclerotic vascular lesions are more prevalent and advanced in patients with a higher BMI than in individuals with a healthy body weight (McGill et al., 2002).

The growing prevalence of obesity among the global population may potentially be a factor in the rising incidence of Type 2 Diabetes Mellitus (T2DM). According to a nationally representative survey conducted in 2011, it was discovered that around 15% of the adult population in Malaysia was affected by type 2 diabetes mellitus, and around 45% were overweight or obese (Jan Mohamed et al., 2015). A gradual increase in body mass catalyzes subsequent metabolic disorders, with type 2 diabetes mellitus being the most intricately linked to obesity. Obesity significantly contributes to the development and advancement of type 2 diabetes mellitus (T2DM) due to its higher susceptibility to genetic andepigenetic influences, modification of the microenvironment to disrupt insulin signaling, impairment of β-cell mass function, and interference with the microbiome-gut-brain axis (Ruzeet al., 2023).

Furthermore, being overweight or obese raises the risk of several severe illnesses, suchas hypertension. A prevalence, awareness, and factor associated with high blood pressure among young female migrant workers in Central South China was investigated in one study, which found that around 27% of the workers had hypertension. A third of the workforce was obese or overweight, with 44% suffering from central obesity (Peng et al., 2022). There was a correlation between excessive weight gain, increased visceral adiposity, and increased sympathetic nervous system (SNS) activity. This has been demonstrated to play a role in the cause of hypertension in both obese experimental animals and humans. An imbalance betweenreactive oxygen species (ROS) and nitric oxide (NO) in the brain may contribute to the inflammatory process and progression of hypertension by mediating obesity-induced SNS activation and hypertension (Carmo et al., 2016).

2.8 Association of Sleep Quality and Obesity

Globally, the increasing prevalence of overweight and obesity has emerged as a significant public health concern. Numerous comorbid conditions, including cancer, cardiovascular disease, and type 2 diabetes, are influenced by overweight and obesity. It is well-established that diet and physical activity are lifestyle-related risk factors for obesity. Recent studies, however, indicate that sleep may also be a significant risk factor to consider (Rahe et al., 2015).

The findings of a European study that examined sleep characteristics in Switzerland from the 1970s to 1990 indicate that the decline in overall sleep duration seems to be associated with delayed wake-up times and a wake-up time that has remained constant throughout the years. A research investigation conducted in China involving over 55,000 children aged 0-16 revealed that individuals who slept for a shorter duration were 76% more likely to be classifiedas overweight or obese compared to those who slept for a longer duration. One hour of additional sleep per day was associated with a 21% decrease in the likelihood of developing overweight or obesity (El Halal & Nunes, 2019).

Multiple potential mechanisms may account for the inverse correlation observed between the duration of sleep and the likelihood of developing obesity or overweight. Hormones produced by the hypothalamus and sympathetic nervous system are both improved by sleep. Sleep deprivation is associated with decreased leptin levels and increased ghrelin levels, suggesting that sleep deprivation may play a significant role in appetite regulation. In addition, sleep deprivation was associated with elevated cortisol levels, a hormone that stimulates fat accumulation and increased food consumption (Ruan et al., 2015).

In addition to these factors, sleep deprivation may contribute to the development of overweight or obesity by extending the time allocated for food consumption and limiting the ability to sustain a healthy lifestyle. When food is readily available and

exceptionally palatable,the number of calories consumed may be directly correlated with the duration of wakefulness.This occurs frequently when most waking hours are spent on sedentary activities, such as watching television, where snacking is prevalent (Chaput, 2010).

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Study Design

This study implemented a cross-sectional study. This research design, alternatively referred to as an observational study, examines population data at a specific moment in time, eliminating the need for participant follow-up that is typical of longitudinal studies (X. Wang & Cheng, 2020). This study design was chosen to assess the association between sleep quality and obesity among undergraduate students at the School of Health Sciences USMKK. The participants in this cross-sectional study were selected only based on specified inclusion and exclusion criteria. The study also evaluates the effects of exposure and outcomes (Setia, 2016). Best ethical practices were followed during the conduct of this study.

3.2 Study Area

This study was conducted at Universiti Sains Malaysia (USM) Health Campus, Kubang Kerian, Kelantan. This study was conducted online for all participants, in which data was collected from an online questionnaire provided by the researcher to the participants. This study encompassed all undergraduate students enrolled in the School of Health Sciences ranging from year 1 to year 4. The rationale for selecting the School of Health Sciences as the focus was the fact that undergraduates in this field were exposed to a greater depth of health knowledge and maintained more regular schedules, in contrast to the students in the School of Medical Sciences or School of Dental Sciences, who tend to have more demanding schedules.

3.3 Study Population

i. References Population

   Undergraduate students in USMKK.

ii. Target Population

   Undergraduate students in the School of Health Sciences in USMKK.

iii. Source Population

   Undergraduate students aged 18 and above in the School of Health Sciences in USMKKduring the study period.

3.4 Subject Criteria

3.4.1 The inclusion criteria are:

i. Individuals aged 19 and above.

ii. Undergraduate students in the School of Health Sciences in USMKK.

iii. Capable of understanding, communicating, reading, and writing in Bahasa Malaysiaand/or English.

iv. Individuals who are willing to participate in the study.

3.4.2 The exclusion criteria are:

i. Individual who has any acute or chronic disease such as diabetes.

ii. Individual who taking long-term medication.

3.5 Sample Size Estimation

One proportion formula was used to determine the approximate sample size for objectives 1 and 2 (Arifin, 2013).

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

n = sample size

Z = value representing the desired confidence level

Δ = precision

p = anticipated population proportion

The value Δ is 0.1 with a confidence interval of 90%, therefore the Z-score will be 1.65.

Table 3.5: Sample size estimation calculation (objectives 1 and 2)

No.	Anticipated Population Proportion	Minimal Sample Size
1.	The percentage of the prevalence of poor sleep quality among university students = 50.4% (Suhaimi et al., 2020). **Therefore, the proportion was 0.504.**	$n = \left[\frac{1.65}{0.1}\right]^2 0.504(1-0.504)$ $n = 68.05$ $\therefore$68 respondents
2.	Percentage of the prevalence of obesity among undergraduate students = 6.3% (Suhaimi et al., 2020). **Therefore, the proportion for obesity was 0.063 respectively.**	$n = \left[\frac{1.65}{0.1}\right]^2 0.063(1-0.063)$ $n = 16.07$ $\therefore$16 respondents

Two proportion formula was used to determine the approximate sample size for objective 3 (Whitley & Ball, 2002).

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

n = sample size

p = anticipated population proportion

α = level of statistical analysis (0.01), z_α (2.58)

1-β = power of study (1.28, 90% power of study)

p_1 = expected proportion of obese students who experienced poor sleep quality

p_2 = expected proportion of non-obese students who experienced poor sleep quality

Table 3.2: Sample size calculation estimation (objective 3)

No.	Anticipated Population Proportion	Minimal Sample Size
3.	The percentage of the obese students who experienced poor sleep quality is 80.0%, and non-obese students who experienced poor sleep quality was 47.6% (Suhaimi et al., 2020). **Therefore, the proportion will be 0.80 for *p1* and 0.476 for *p2*.**	$n = \frac{0.80(1-0.8) + 0.476(1-0.476)}{(0.80-0.476)^2}$ $n = \frac{(0.80-0.2) + (0.476-0.524)}{(0.324)^2}$ $n = \frac{0.409}{(0.324)^2}\ (3.86)^2$ $n = 58\ in\ each\ group$ $\therefore 58 \times 2 = 116$ respondents

Therefore, from all calculations, the biggest minimal sample size was 116 respondents. Considering drop-out rates of 10%, the real sample size was calculated as follows:

Sample size (n) = 116 + (116 × 10%) = **128 respondents**.

3.6 Sampling Method and Subject Recruitment

The non-probability convenient sampling method was used to select the students who fulfilled the inclusion and exclusion criteria to study the association between sleep quality and obesity among undergraduate students at the Schools of Health Sciences USMKK. This method was convenient for the researcher as well as the respondents as they can be accessed easily and have been available at a given time. The respondents were recruited through a WhatsApp group.

3.7 Research Tool and Instrument for Data Collection

This study involved collecting anthropometric data and utilizing an online self-administered questionnaire. The questionnaire was given in an online form. The questionnaire consisted of three parts; Part I: Socio-demographic Characteristics, Part II: Anthropometry Measurement, and Part III: Sleep Quality. The time taken to complete the assessment and questionnaire was around 30 minutes.

Part I: Socio-demographic Characteristic

The socio-demographic characteristics documented included age, gender, ethnicity, marital status, current residence, year of study, and course. Respondents' personal information such as name, matric number, or phone number was not collected in these questionnaires due to their privacy and confidentiality.

Part II: Anthropometry Measurement

The anthropometric data was collected using a digital weighing scale. The weight scale was set up on a stable and level surface. During the assessment, subjects wore light clothing and were reminded to remove any footwear and empty their pockets. Respondents were asked to stand in the center of the weight scale without any kind of support, with their weight evenly distributed on both feet. The stadiometer was used to

determine the height. The respondent must stand with their feet and heels close together and their buttocks and upper back touching the scale. Each respondent's height and weight were measured twice, and average numbers were recorded to reduce error. The weight (kg)/height (m^2) ratio was used to convert the height and weight measurements into BMI. Then, the BMI will be classified according to the Clinical Practice Guidelines Management of Obesity (CPGs Obesity, 2023).

Table 3.3: BMI-based weight classification for adults (>18 years old)

Classification	**BMI (kg/m^2)**
Underweight	<18.5
Normal	18.5 – 22.9
Pre-obese (Overweight)	23.0 – 27.4
Obese I	27.5 – 32.4
Obese II	32.5 – 37.4
Obese III	≥37.5

Waist circumference was measured using a measuring tape, with measurements made halfway between the lowest ribs and the iliac crest on a horizontal plane. Two measurements to the nearest 0.5 cm were recorded and if the variation between the measurements is greater than 2 cm, a third measurement was taken. The meaning of the two closest measurements was calculated. For Asian countries, the cut-off point is 90cm in men and 80cm in women (CPGs Obesity, 2023).