



Interlinked Association Between Body Mass Index, Nutritional Patterns and Menstrual Disorders in Female Students of King Saud University

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Abstract

Background: Menstrual disorders are considered to be the most prevalent health issues among young reproductive aged university students. Obesity is one of the factors affecting the younger women during their menstruation. Apart from it, obesity is a common factor in the Saudi population. Therefore, this study aims to investigate the relationship between obesity/body mass index (BMI) nutritional patterns and menstrual disorders in Saudi female students.

Method: This cross-sectional study was conducted at King Saud University, focusing on the elevated BMI values and eating patterns on menstrual cycle disorders among the female Saudi students. This study included a total of 220 bachelor students, aged 18 to 25, who were Saudi nationals, not using contraceptives, and free from chronic diseases. Data was collected through an online self-administered questionnaire, which consisted of demographic information, eating behaviors, and menstrual cycle disorder data. The collected data was analyzed using SPSS software, and descriptive statistics were employed to accurately interpret and present the findings.

Results: This study confirms a correlation between BMI and menstrual disorders, specifically the amount of bleeding during the menstrual cycle. Additionally, dietary patterns were found to be related to these disorders. Notably, protein, vegetables, fruits, and regular water consumption were significantly correlated with menstrual disorders. Conversely, the consumption of fast food was associated with the regularity of the menstrual cycle. Furthermore, a relationship was observed between the psychological state and menstrual disorders, including symptoms such as diarrhea/constipation and nausea/vomiting.

Conclusion: This research emphasizes the significant impact of nutritional patterns on menstrual disorders, with BMI playing a crucial role in determining the amount of bleeding during menstruation. These findings highlight the importance of conducting further investigations and developing intervention strategies to enhance our understanding and management of menstrual disorders.

Keywords: Body Mass Index (BMI); Menstrual Disorders; Disorders of Menstruation; Diet; Nutrition Habit; Nutritional Patterns; Obesity; Stress

Introduction

Accumulation of fat in the human body that exceeds its normal levels and is causing health problems is defined as the obesity. Even overweight comes as a secondary category for preceding obesity [1]. Obesity/obese is widely recognized as complex metabolic condition in humans and mainly it is a major health concern on a global scale, impacting around 400 million population. Obesity rates have nearly tripled worldwide in recent decades, according to the recent studies. It is estimated that around 1.9 billion adults are presently considered overweight. Visceral adipose tissue in humans is more closely associated to metabolic illness than subcutaneous adipose tissue. Obesity has become a pandemic and a

huge hardship in one of the high-income countries, particularly in the Kingdom of Saudi Arabia [2]. The incidence of overweight and obese adults was higher among women than it was among men by the year 2022, with 43% of adults globally being categorized as overweight and 16% as obese [3]. Obese populations have been found to experience a deleterious impact on the metabolism of micronutrients due to increased body fat. Furthermore, humans who are obese are prone to experiencing nutritional imbalances due to their reliance on affordable, calorie-dense, and nutrient-poor foods. Obese individuals are currently confronted with a complicated dietary issue marked by the simultaneous presence of inadequate and excessive nutrition. The term "double burden of mal-

nutrition" has been used to describe a situation when there is both high calorie consumption and a deficiency in certain essential micronutrients [4]. Research has indicated that being overweight or obese can potentially impact micronutrients levels in the body due to an unbalanced intake, absorption, distribution, metabolism, or excretion of these nutrients. Research has shown that adults who are overweight or obese are more likely to have lower levels of several micronutrients in their blood, including α -carotene, β -carotene, β -cryptoxanthin, lutein/zeaxanthin, total carotenoids, vitamin C, selenium, and folate, compared to adults who have a normal weight [5].

The dietary composition in human behavior has been demonstrated to be an independent risk factor for overweight and obesity [6]. Little is known regarding the dietary components that lead to weight increase and the onset of obesity, even though excess fat is the consequence of an energy imbalance between consumption and expenditure. Dietary patterns, due to their cumulative nature, have a greater impact on long-term weight gain or maintenance than individual nutrient or food intake [7]. Because of the high prevalence of a specific types of obesity, the so-called Middle-Eastern pattern, which makes Middle Eastern populations very vulnerable to increased risk of obesity-related comorbidities, it is particularly relevant to study the links between dietary patterns and different forms of obesity for these populations. The most prominent feature of obesities in women, is the buildup of fat around the middle and an expanded waist circumference (WC). Abdominal obesity affects half of the adult female population in these nations [8]. The World Health Organization (WHO) confirms the greater prevalence was recorded among women with 40% worldwide, compared to men with 35% [9]. When it comes to the Saudi population, WHO has determined the higher prevalence of obesity in 39.5% of women and 29.5% in males [10]. Elevated weight gain in women will leads to irregular menstruation, anovulation, high chances of miscarriage, adverse neonatal and maternal outcomes [11].

Usually, adolescence comes between the onset of puberty and the attainment of legal adulthood; it is a time of significant physical and psychological change for humans. At this time, their bodies undergo rapid changes, and further develops new challenges. Menstrual issues, particularly in females, pose the greatest challenge. The menstrual cycle is an indicator of the well-being of women. Incontinence and other menstrual cycle disorders affect a large percentage of adult females, particularly teenagers, and cause a great deal of distress for both the affected individuals and their families [12].

Food habits, physical activity, and consumption of stimulants all have a substantial impact on the menstrual cycle. These components affect the body mass index (BMI) and the amount of body fat, both of which are directly related to ovulation difficulties, as well as uncomfortable and irregular menstruation [13]. Amenorrhea, dysmenorrhea, premenstrual syndrome, oligomenorrhea, polymenorrhea, hypomenorrhea, and abnormal uterine bleeding are all considered menstrual disorders. Nevertheless, irregular menstruation can result in ovarian dysfunction and elevate the susceptibility to various diseases, including ovarian cancer, osteoporosis, diabetes, breast cancer, and cardiovascular disease. Among the common menstrual disorders that women experience is dysmenorrhea, anomalies in the duration and amount of bleeding, premenstrual syndrome, irregular menstruation, and heavy bleeding [14,15]. Numerous studies have linked obesity to a host of chronic diseases, including type 2 diabetes, heart disease, lung disease, and reproductive problems, in addition to the obvious negative effects on health that obesity has on its own. Women whose body mass index (BMI) is greater than 30 kg/m² are 2.7 times more likely to experience infertility, while pregnant women whose BMI is between 25 and 37 kg/m² are 25 to 37 percent more likely to experience a miscarriage than their normal-weight counterparts [16].

Alhammadi, *et al.* studies in Saudi women confirmed irregular menstrual abnormalities among medical students [17], although there are no direct studies linking BMI, dietary pattern, and menstrual disorders in Saudi women university students. The prevalence of women in Saudi Arabia is 15.96 million, compared to the male population of 21.51 million, and this study is important to understand the menstrual disorders that arises in the young Saudi women. Therefore, the purpose of this study was designed to investigate the interlinked association between BMI, nutritional patterns and menstrual disorders in Saudi female students.

Materials and Methods

The study is a cross-sectional study conducted on a random sample of students from King Saud University (KSU) in Riyadh. The student subjects were enrolled within the university premises from different colleges such as scientific, humanitarian, medical, and administrative units. This study was carried out in October and November of 2023. The inclusion criteria for the enrolment of female students were (i) KSU bachelor-degree students (ii) age should be between 18-25 years, (iii) Saudi female students who were not using contraceptive pills and (iv) free from any chronic diseases. The exclusion criteria were (i) students over 25 years of age, (ii) non-KSU students and (iii) pregnant students.

This cross-sectional study aimed to identify the different forms of elevated BMI levels, eating patterns and on menstrual cycle disorders. The questionnaire was developed based on validated questionnaires, namely the Menstrual Distress Questionnaire (MEDI-Q) and the Menstrual Symptom Questionnaire (MSQ) [18].

The data collection tool used was an online self-administered questionnaire, consisting of three sections. The first section included students' demographic data, the second section included data on students' eating behaviours, and the third section included data on students' menstrual cycle disorders. The survey would automatically end for students who did not meet the inclusion criteria in any of the eight questions from the first section. Prior to starting the study, a pilot test of the questionnaire was conducted to enhance its validity [19].

The total sample size included in our study was 220 bachelor students at King Saud University. Those who did not meet the criteria were excluded ($n = 190$). The survey was distributed to students online through WhatsApp groups that included students from King Saud University across different majors, as well as through email by sending the survey to students from various clubs in King Saud University and asking them to share it with their section group chat. Furthermore, ethical approval for conducting this research was obtained from the College of Medicine Institutional Review Board of King Saud University on October 5th, 2023 (E-23-8148).

Statistical analysis

The collected data were analysed using SPSS software. In this study Chi-square test used to know the relationship between psychological state and menstrual disorders, also spearman correlation test used to know the relationship between BMI and menstrual disorders, and ANOVA test to know the relationship between nutritional patterns and menstrual disorders. Descriptive statistics were performed to accurately interpret and present the characteristics of the participants, as well as the BMI and menstrual disorders.

Results

In this study, a total of 190 Saudi students were involved between the age range of 18-25 years of the age. The basic details were showed in Table 1. The overall mean age of 190 participants were 21.28 ± 1.53 . The mean BMI value was found to be 23.16 ± 5.41 which is considered as normal levels based on mean weight (59.01 ± 16.07) and height (158.23 ± 10.06). In this study, all the students were participated from four different colleges such as 48.9% of them were from medical college, 18.9% from humility

S. No	Basic details	Mean (SD)
1	Age	21.28 ± 1.53
2	Weight	59.01 ± 16.07
3	Height	158.23 ± 10.06
4	BMI	23.16 ± 5.41
5	Humanity	36 (18.9%)
	Management	28 (14.7%)
	Medical	93 (48.9%)
	Science	33 (17.4%)
6	Married/Unmarried	05 (2.6%)/185 (97.4%)
7	Psychological disorder	70 (36.8%)
8	Smoking	11 (5.8%)

Table 1: Basic details of students' involvement in this study.

college, 17.4% from science college and 14.7% from the management. Only 2.6% of the students were married and 97.4% of them were bachelors. In this study, 36.8% of the women had psychological disorder and 5.8% of them were smoking. The average menstrual cycle involved in all the women was found to be 6.91 ± 3.79 .

Table 2 in this study gives the information towards the nutritious status and regular physical activity. The 20% of the women regularly munch the fast food, while, 46.8% and 24.2% of the women will have the habit of munching sometimes and rarely. Only, 8.9% of them will never ate the fast food. Almost, one-fourth i.e., 24.7% of the students had the healthy habit of eating fruits and vegetables. Although, 44.7% and 20% of them will eat occasionally and rarely. The 10.5% of the women was not having the eating habit of fruits and vegetables. In this study, one-third women i.e., 37.4% of them having the regular habit of consuming water. The 42.6% of the women will consume water on regular intervals but not regularly. The 15.3% of the students will drink rarely and 4.7% of them will consume very less. In this study, there are 7.2% of the women who were never had sweets; high calorie consumption was sometimes found in 43.2% of the women and 14.2% will eat rarely. The remaining 35% of the students will consume on a regular basis. More than 57.9% of the women will have the regular protein source in their food; however, 8.4% and 29.6% of the protein will be consumed rarely and occasionally based on their convenience. The 4.2% of the students will not take care of their protein source. The physical activity record was reported to be very low i.e., only 26.8% of them will have the regular physical activity; while, 35.8% of them will have the moderate and 22.1% of them will have the rare physical activities. The 15.3% of the women is not active in the physical activity.

Table 2: Students regular activity and nutritional status.

S. No	Nutritional information	Always	Sometimes	Rarely	Never
1	Fast food	38 (20.0%)	89 (46.8%)	46 (24.2%)	17 (8.9%)
2	Healthy food (fruits and vegetables)	47 (24.7%)	85 (44.7%)	38 (20.0%)	20 (10.5%)
3	Water consumption	71 (37.4%)	81 (42.6%)	29 (15.3%)	09 (4.7%)
4	High calorie sweets	67 (35.3%)	82 (43.2%)	27 (14.2%)	14 (7.2%)
5	Protein Source	110 (57.9%)	56 (29.6%)	16 (8.4%)	08 (4.2%)
6	Physical activity	51 (26.8%)	68 (35.8%)	42 (22.1%)	29 (15.3%)

The table 3 in this study will discuss the issues with the menstruation in the 190 students involved in this study. In this present study, 95.3% of the lower abdominal pain was recorded during or before the menstrual periods in which 58.9% was regular, while, 23.7% were moderate and 12.6% occurs rarely. Only 4.7% of them will not have the abdominal pain. Around 56.3% of the students will have the issue the menstrual pain in three categories such as mild (14.7%), moderate (23.7%) and severe (17.9%). The remaining 43.7% of them has no issues. More than 90% of the students have troubled with bloated pain during the menstruation and 9.5% of the students was not involved with bloating during their periods. The 54.2% of the women has a regular issue of suffering from muscle, joint and bone pain, while, 24.7% of the women feels moderately and 14.7% as very low frequency during their menstruation. Only, 13.7% of the students have no pains. Approximately 75% of the women had a nausea or vomiting issues during their menstruation in different forms and remaining 25.8% of the women

has never an issue either with nausea or bloating. Nearly, 79.5% of the students were positive and remaining 20.5% of them were negative towards constipation or diarrheal issues. One fourth of the students had the breast pain during the menstrual cycle and 20% of the students were not having any of the breast issues. In this study, 37.4% of the women were regularly consumed pain killer as medication during their menstrual issues. The remaining 21.6% of them were irregularly, 16.3% as rarely and 24.7% of them were not consumed the pain killers. Only 2.6% of the students were not having regular issues with mood fluctuations and remaining women was categorized as 63.7% as regular, 22.6% as restrained and 11.1% as rarely feel emotionally unstable and it effects the fluctuations in the mood. The 93% of the women were feeling anxious, nervous and agitated during the menstruation, while, 95% of them were tiered and around 86% of them were frequently hunger. Around 33.7% of the women were weight gained during the menstrual cycle, 17.9% as occasionally and 12.1% as rarely. However, 36.3% of the women has not gained the weight during their menstrual period.

Table 3: List of menstrual issues in the participated women.

	Menstrual disorders	Always	Sometimes	Rarely	Never
1	Lower abdominal pain during before/during your periods	112 (58.9%)	45 (23.7%)	24 (12.6%)	09 (4.7%)
2	Did Menstrual pain begin before it continues even after ended	34 (17.9%)	45 (23.7%)	28 (14.7%)	83 (43.7%)
3	Did you feel bloated before/during your period	106 (55.8%)	50 (26.3%)	16 (8.4%)	18 (9.5%)
4	Have you been suffering from muscle/joint/bone pain before or during your menstrual cycle	103 (54.2%)	47 (24.7%)	14 (7.4%)	26 (13.7%)
5	Did you feel nausea or suffering from vomiting before or during your menstrual period	61 (32.1%)	44 (23.3%)	36 (18.9%)	49 (25.8%)
6	Did you suffer from constipation or diarrhea before or during your menstrual period	78 (41.1%)	45 (23.7%)	28 (14.7%)	39 (20.5%)
7	Did you suffer from breast pain before or during your menstrual cycle	80 (42.1%)	44 (23.2%)	28 (14.7%)	38 (20.0%)
8	Did you take pain killers before or during the menstruation	71 (37.4%)	41 (21.6%)	31 (16.3%)	47 (24.7%)
9	Did you feel emotionally unstable (mood fluctuations even at the slightest stimulus) before or during your menstruation period	121 (63.7%)	43 (22.6%)	21 (11.1%)	05 (2.6%)
10	Were you feeling anxious i.e., excessively nervous or agitated	85 (44.7%)	69 (36.3%)	22 (11.6%)	14 (7.4%)
11	Did you feel very tiered	102 (53.7%)	62 (32.6%)	17 (8.9%)	09 (4.7%)
12	Do you feel frequent hunger	81 (42.6%)	55 (28.9%)	28 (14.7%)	26 (13.7%)
13	Did you suffer from weight gain before your period	64 (33.7%)	34 (17.9%)	23 (12.1%)	69 (36.3%)

All the 190 students were divided into 4 groups of BMI categorization as (i) 70.5% as normal BMI levels, (ii) 17.9% as overweight women, (iii) 7.9% as obesity criteria and finally (iv) 3.7% of morbid obesity women as mentioned in Table 4. The BMI levels were found to be high levels starting from normal levels (20.41 ± 2.43), overweight (27.11 ± 1.47), obese (31.63 ± 1.19) to morbid obesity (101.71 ± 12.35). The consumption of fast food was found to be high in morbid obesity women (100%), then next obesity (80%), overweight (70.6%) and normal category (62.7%). Healthy fruit intake was shown to be high in 73.5% of overweight women, followed by 72.4% of women with normal BMI levels, 46.7% of obese

women, and 42.9% of morbidly obese women. Overweight women drank the most water (97.1%), followed by women with normal BMI levels (79.1%), obesity (66.7%), and severe obesity (42.9%). The high calorie sweet was consumed to be high in 100% of morbid women, followed by obesity women with 80%, 79.4% with overweight and 76.9% with normal BMI levels. Interestingly, the 100% prevalence of protein source food was consumed by both morbid obesity and obesity women and then 94.1% with morbid obesity and finally, 85.8% with normal BMI levels. As expected, the regular physical activity was found to be high in 67.2% of women with normal BMI levels, 64.7% in overweight women, 33.3% in obese women and 28.6% of morbid obese women.

Table 4: Categorization of nutritious status based on BMI levels.

	Normal BMI (n = 134)	Overweight (n = 34)	Obesity (n = 15)	Morbid Obese (n = 7)
BMI	20.41 ± 2.43	27.11 ± 1.47	31.63 ± 1.19	101.71 ± 12.35
Fast-food	84 (62.7%)	24 (70.6%)	12 (80.0%)	07 (100%)
Healthy Fruits	97 (72.4%)	25 (73.5%)	07 (46.7%)	03 (42.9%)
Water consumption	106 (79.1%)	33 (97.1%)	10 (66.7%)	03 (42.9%)
High calorie sweet	103 (76.9%)	27 (79.4%)	12 (80.0%)	07 (100%)
Protein source	115 (85.8%)	32 (94.1%)	15 (100.0%)	07 (100%)
Physical activity	90 (67.2%)	22 (64.7%)	05 (33.3%)	02 (28.6%)

Next, we have discussed the menstrual problems of the participated students based on age criteria as shown in Table 5. The age of women contributed in this study was divided three divisions as (i) 16.8% of women were in the age range of 19-20 years, (ii) 76.8% were between 21-23 years and (iii) 6.8% were 24-25 years. The mean age of the 3 groups were found to be 19.47 ± 0.54 , 21.86 ± 0.86 and 24.36 ± 0.39 years of the ages. The 84.9% of abdominal pain was reported in middle-aged women, between 21-23 years of age, followed by 75% in both initial grouped age, between 18-19 years of age, and final grouped aged women, between 24-25 years of age. The 83.3% of the breast pain was confirmed in the final grouped aged women, followed by 65.1% in middle-aged women and 59.4% in the initial grouped aged women. The mood fluctuations were observed in middle-aged group (87.7%) followed by final grouped aged women (83.3%) and then initial aged grouped women (81.3%). The 91.7% of the final aged women were found to be starving followed by 70.5% in middle-aged women and 68.8% in the initial aged women. The weight gain

was found to be high in final aged women with 83.3%, 50.7% in middle-aged and 43.8% in the initial aged women. The pattern of regular menstruation was found to be 62.3% in the middle-aged women, 53.1% in the initial aged grouped women and 50% in the final aged grouped women. Simultaneously, the frequency of the blood loss was also the similar pattern of menstruation pattern such as 89.7% of the middle-aged women was having higher frequency of regular blood loss, followed by 87.5% in the initial and 75% in the final-aged women.

Figure 1 explains the menstrual pattern in the students participated in this study. The 60% of them will lose the blood regularly during their menstrual periods. However, 29.5% and 9.5% of them will lose irregularly and very irregular. 1.1% of them will discontinue during their menstruation. Figure 2 elaborates the 98.9% of the students will lose their blood in which 24.2% of them will frequently loss their blood heavily, while, around 64.2% of them will lose blood moderately. The 10.5% of the women will lose low amount and 1.5% of them will lose very low amount of blood.

Table 5: Categorization of menstrual issues based on age.

	Age (19-20 Years) [n = 32]	Age (21-23 Years) [n = 146]	Age (24-25 Years) [n = 12]
Age	19.47 ± 0.54	21.86 ± 0.86	24.36 ± 0.39
Lower abdominal Pain	24 (75.0%)	124 (84.9%)	09 (75.0%)
Breast Pain	19 (59.4%)	95 (65.1%)	10 (83.3%)
Mood fluctuations	26 (81.3%)	128 (87.7%)	10 (83.3%)
Feeling Hunger	22 (68.8%)	103 (70.5%)	11 (91.7%)
Weight gain	14 (43.8%)	74 (50.7%)	10 (83.3%)
Regular menstrual Pattern	17 (53.1%)	91 (62.3%)	06 (50.0%)
Frequent of regular blood loss	28 (87.5%)	131 (89.7%)	09 (75.0%)

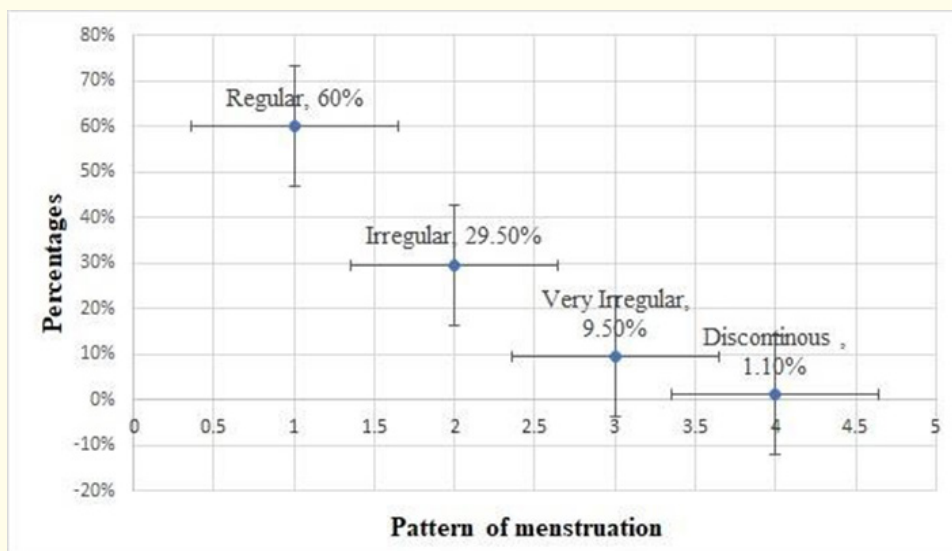


Figure 1: Pattern of the menstruation in the participated women.

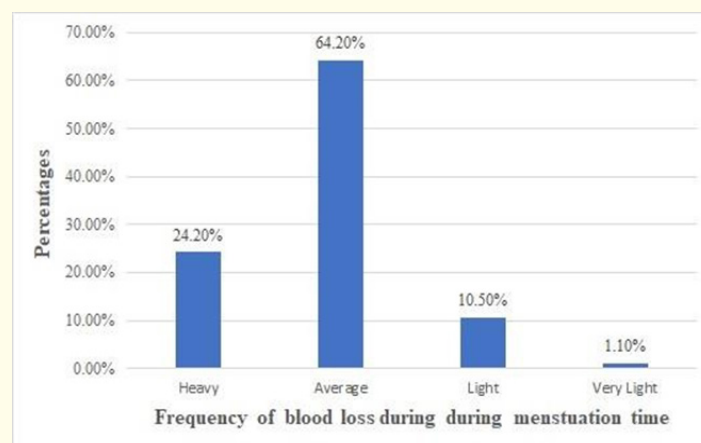


Figure 2: Frequency of blood loss during the menstruation.

Discussion

The aim of this study was to correlate the relation between interlinked association in BMI, nutritional patterns and menstrual disorders in Saudi female students. The current study results have confirmed the impact of dietary patterns in menstruation disorders recorded in this study. The findings clearly showed the relation between eating habits and the presence of menstrual abnormalities. Moreover, BMI has been revealed as a major factor influencing the amount of bleeding during menstruation. However, we have defined the results and compared with the global studies in detailed as follows.

In the Arabian Peninsula region, the Kingdom of Saudi Arabia is one of the largest territories, covering around 2.1 million km² and reside and more than 30 million people. Saudi Arabia is a rapidly developing country that has adapted to the growing urban culture [20].

According to documented studies, the prevalence of obesity in adult females in Saudi Arabia is among the highest globally [21]. However, Alshaikh, *et al.* has confirmed 28.7% of Saudi women aged with fifteen years above obese and the obesity risk is increased due to age, marriage, previously married, diagnosed with chronic diseases. Additionally, the Saudi women who were educated were found to be restricted with high BMI levels [20]. In our study, the overall BMI levels were 23.16 ± 5.41 which is found to be healthy levels. However, when we have categorized BMI levels, we have confirmed 70.5% of the students were found to be having normal BMI levels i.e., $<24.9\text{kg/m}^2$, while, 17.9% of students were overweight ($25.0\text{-}29.9\text{kg/m}^2$), 7.9% and 3.7% were obesity ($30.0\text{-}34.9\text{kg/m}^2$) and morbid obese ($> 35.0\text{kg/m}^2$). In our study, the morbid BMI levels were in the range between $35.5\text{-}48.2\text{kg/m}^2$ among 3.7% women. However, our study was found to be in agreement with the previously documented study regarding the prevalence of obesity in the educated women [20]. We predict that one of the reasons for 3.7% of women turning into morbidly obese is because to the pandemic condition in the form of COVID-19 in Saudi Arabia [22].

Worldwide, it was documented as the prevalence of physical inactivity was more prevalent in women rather than the men [23]. Additionally, WHO report 2022 has confirmed that 85% of adolescents women were lacking with regular physical activity [24]. One of the previous studies from van Sluijs, *et al.* group was also discovered the similar issue and these adolescents girls can develop

cardiometabolic and mental health disorders in the future [25]. However, a recently published meta-analysis studies has confirmed that because of COVID-19, sedentary life style, physical inactivity and poor diet were developed and this has leads to the development of obesity and additionally, panic situations was also arises and it leads to high pandemic situation [26]. As expected, in our study, the regular physical activity was found to be high in 67.2% of women with normal BMI levels, 64.7% in overweight women, 33.3% in obese women and 28.6% of morbid obese women. According to the WHO report, throughout the lockdown period, human habits and lifestyles transformed completely. Individuals began to consume high calorie consumption with absolutely minimal physical activity [27]. Physical inactivity has become a risk factor for obesity during the lockdown period [28] and it was in agreement with the previous studies [29,30]. Studies conducted among university students in Saudi Arabia have revealed a significant lack of physical exercise, particularly among female students. This is mostly attributed to time limitations. These findings emphasize the need of promoting physical activity as a means to alleviate stress and enhance overall health [31-33]. In our study, 26.8% of women were regular towards the physical activity and 35.8% were almost regular apart from their busy schedules and our study is in agreement with the previously published studies inside [34] and out the Saudi Arabia [35]. However, contrasting results were published in the adult Saudi women who were found to be high inactive in the physical exercise [36].

A healthy nutritional diet plays an important role in the women's life during their adolescence age. During adulthood i.e., between 18-25 years of the age, there is a heightened need for nutrients due to the rapid physical growth that takes place, making this period nutritionally susceptible. The dietary habits formed during adolescence might contribute to nutrition-related issues that can have long-term health repercussions [37].

Healthy nutrition will lead to significant height and regular weight and muscle mass are gained during this age period in both boys and girls. However, unhealthy nutrition diet will lead to nutrition related issues and obesity is a major problem that effects the health for the long-term. Consuming fruits and vegetables are essential since they supply energy, vitamins, antioxidants, fiber, and water. Protein-rich foods play a crucial role in supporting growth and muscle development during the period of puberty. Animal sources of protein-rich foods include lean meat, fish, chicken, and eggs. Vegetable sources such as beans, lentils, chickpeas, tofu, and

nuts are known to be rich in proteins. Essential for growth and development. The inclusion of omega 3 fatty acids in their composition is noteworthy, as these compounds are known to have a significant impact on brain development and learning processes. Animal sources of protein-rich foods also contain zinc and vitamin B12. According to studies, clean water is considered to be the healthiest and most affordable drink option. It is recommended that individuals consume sufficient amounts of water to prevent dehydration and fatigue. It is strongly encouraged that adolescents select snacks from healthy food groups. The foods that are included in the diet are nuts, cheese, low-fat yogurt, fresh fruit, and vegetables [38]. In our study, the consumption of regular fast food was found to be 20% and on a regular basis with a gap was found to be around 46.8% which is very high and similar results were obtained from previous studies [39-43]. Abdelrazek, *et al.* studies has also confirmed as female students from Northern Border University had the poor eating habits in the Saudi Arabia [44]. However, Alshahrani, *et al.* has performed an online questionnaire study from a couple of universities from Jeddah region and confirmed 40.4% of the mixed gender students confirmed poor nutritional literacy [45]. One of the previous studies from Saudi Arabia has confirmed the poor dietary habits among the Saudi medical students in both male and female subjects [46]. Differently, Mohammed, *et al.* has carried out a study among the 400 foreign male students who were residing in KSU since above 180 days and confirmed them as majority of the students were overweight and remaining were obese [47]. A total of 35.3% of the female students in our study ingested high-calorie foods on a regular basis, and our study was supported by prior work that was documented from Jeddah city, in which 53.6% of the adolescent females was consumed [48]. Our study was found to be in agreement with the previously documented studies around the globe [49-55].

Menstrual disorders are regarded as a gynecological issue among women in reproductive health. A menstrual disturbance in women disrupts the menstrual cycle and causes a different irregularity, including amenorrhea, menorrhagia, oligomenorrhea, polymenorrhea, hypomenorrhea, dysmenorrhea, and premenstrual syndromes [56]. A prior study from a university in Abha city confirmed that 70.6% of women suffered dysmenorrhea [57]. Another study by Abdel-Salam, *et al.* confirmed that the prevalence of dysmenorrhea among female students at Jouf University was approximately 88% [58]. However, Rafique, *et al.* verified an 89.7% prevalence of dysmenorrhea at a university in Dammam, Saudi Arabia [59]. However, in our study, the frequency of dysmenor-

rhea was classified as lower abdomen pain (82.6%), menstrual pain (41.6%), and muscle pain during menstruation (78.9%). India has 72.4% of the global population, followed by Italy at 70% and Australia at 80% [60-62]. The various prevalences of dysmenorrhea among Saudi university female students were documented [63-65].

Contrary to the findings of Sawitri, *et al.* the results of our study did not provide evidence to support the hypothesis that there is an association between menstrual disorders and BMI [14]. Our research revealed a noteworthy correlation between the extent of bleeding and BMI, which is consistent with the findings of the previous study [66]. Our research indicates a significant correlation between protein consumption, vegetable and fruit intake, and regular water consumption with symptoms such as frequent hunger, breast pain, diarrhea and constipation, nausea and vomiting, muscle, bone, and joint pain, lower abdominal pain, and the amount of blood loss. These findings align with the results reported by previous studies [67].

The strength of this study has confirmed as all the students were native of KSU and specifically central region of the kingdom. The limitations of this study include the inability to show a cause-and-effect relationship between BMI, dietary patterns, and menstrual problems. The fundamental limitations of this study are its tiny and insufficient sample size. Furthermore, there was an unequal distribution of the BMI groups. As a result, the study did not receive the desired amount of responses for each category. Furthermore, all data, including weight, height, dietary information, and psychological health, were self-reported, increasing the possibility of bias. Furthermore, due to the short time available for conducting the study, the number of replies was reduced.

Conclusion

In overall conclusion, the results of this study significantly demonstrate the importance of dietary patterns in menstruation problems. The findings clearly show the relation between eating habits and the presence of menstrual abnormalities. Furthermore, BMI has been discovered as a major factor influencing the amount of bleeding during menstruation. This study underscores the need of taking into account both food patterns and BMI while examining the causes and treatment of menstruation problems. Further research and intervention techniques are required to get a clearer knowledge of the complex interplay between these factors and menstruation health, as well as to develop effective approaches to addressing these concerns.

Bibliography

1. Alshammary AF and IA Khan. "Screening of obese offspring of first-cousin consanguineous subjects for the angiotensin-converting enzyme gene with a 287-bp Alu sequence". *Journal of Obesity and Metabolic Syndrome* 30.1 (2021): 63.
2. Alharbi KK, et al. "Relationship between serum amyloid A1 (SAA1) gene polymorphisms studies with obesity in the Saudi population". *Diabetes, Metabolic Syndrome and Obesity* (2021): 895- 900.
3. Vieira de Sousa JP, et al. "Assessing Nutritional Deficiencies in Bariatric Surgery Patients: A Comparative Study of Roux-en-Y Gastric Bypass versus Sleeve Gastrectomy". *Journal of Personalized Medicine* 14.6 (2024): 650.
4. Gebler L, et al. "Nutritional deficiencies associated with obesity". *Journal of Obesity and Weight Loss Therapy* 5.252 (2015): 2.
5. Lin SP, et al. "Relationship between overweight and obesity and insufficient micronutrient intake: a nationwide study in Taiwan". *Journal of Nutritional Science* 12 (2023): e48.
6. Wang Yy, et al. "The relationship between dietary patterns and overweight and obesity among adult in Jiangsu Province of China: a structural equation model". *BMC Public Health* 21.1 (2023): 1225.
7. Schulze MB, et al. "Dietary patterns and changes in body weight in women". *Obesity* 14.8 (2006): 1444-1453.
8. Esmailzadeh A and L Azadbakht. "Major Dietary Patterns in Relation to General Obesity and Central Adiposity among Iranian Women, 3". *The Journal of Nutrition* 138.2 (2008): 358-363.
9. <https://www.who.int/>, W.H.O.O.a.O.W.G.I.A.o. and n.-r.f.-s.d.o.-a.-o.a.o.A. (2024).
10. Alsulami S, et al. "Obesity prevalence, physical activity, and dietary practices among adults in Saudi Arabia. *Frontiers in Public Health* 11 (2023): 1124051.
11. Mazza E, et al. "Obesity, Dietary Patterns, and Hormonal Balance Modulation: Gender-Specific Impacts". *Nutrients* 16.11 (2024): 1629.
12. Thapa B and T Shrestha. "Relationship between body mass index and menstrual irregularities among the adolescents". *International Journal of Nursing Research and Practice* 2.2 (2015): 7- 11.
13. Ciołek A, et al. "An Assessment of Women's Knowledge of the Menstrual Cycle and the Influence of Diet and Adherence to Dietary Patterns on the Alleviation or Exacerbation of Menstrual Distress". *Nutrients*, 16.1 (2023): 69.
14. Sawitri DPM, et al. "The correlation between body mass index and menstrual cycle disorders in medical students of Udayana University". *People* (2020).
15. Dhar S, et al. "Influence of lifestyle factors with the outcome of menstrual disorders among adolescents and young women in West Bengal, India". *Scientific Reports* 13.1 (2023): 12476.
16. Yong W, et al. "Role of obesity in female reproduction". *International Journal of Medical Sciences* 20.3 (2023): 366.
17. Alhammadi MH, et al. "Menstrual cycle irregularity during examination among female medical students at King Abdulaziz University, Jeddah, Saudi Arabia". *BMC Women's Health* 22.1 (2022): 367.
18. Vannuccini S, et al. "Menstrual Distress Questionnaire (MEDI-Q): a new tool to assess menstruation-related distress". *Reproductive Biomedicine Online* 43.6 (2021): 1107-1116.
19. Sundram S and N Romli. "A Pilot Study to Test the Reliability and Validity of The Research Instrument". *Malaysian Journal of Social Sciences and Humanities (MJSSH)* 8.3 (2023): e002149-e002149.
20. Alshaikh MK, et al. "Women in Saudi Arabia and the prevalence of cardiovascular risk factors: a systematic review". *Journal of Environmental and Public Health* 2016.1 (2016): 7479357.
21. Aljefree N and F Ahmed. "Prevalence of cardiovascular disease and associated risk factors among adult population in the Gulf region: a systematic review". *Advances in Public Health* 2015.1 (2015): 235101.
22. Alshahrani SM, et al. "The impact of COVID-19 pandemic on weight and body mass index in Saudi Arabia: a longitudinal study". *Frontiers in Public Health* 9 (2022): 775022.

23. Organization WH. "Interventions on diet and physical activity: what works: summary report" (2009).
24. Report W. (2022).
25. van Sluijs EM., *et al.* "Physical activity behaviours in adolescence: current evidence and opportunities for intervention". *The Lancet* 398.10298 (2021): 429-442.
26. Nour TY and KH Altıntaş. "Effect of the COVID-19 pandemic on obesity and its risk factors: A systematic review". *BMC Public Health* 23.1 (2023): 1018.
27. Organization WH. WHO highlights high cost of physical inactivity in first-ever global report (2022).
28. Di Renzo L., *et al.* "Eating habits and lifestyle changes during COVID-19 lockdown: an Italian survey". *Journal of Translational Medicine* 18 (2020): 1-15.
29. Keel PK., *et al.* "Gaining "The Quarantine 15:" Perceived versus observed weight changes in college students in the wake of COVID-19". *International Journal of Eating Disorders* 53.11 (2022): 1801-1808.
30. Sidor A and P Rzymiski. "Dietary choices and habits during COVID-19 lockdown: experience from Poland". *Nutrients* 12.6 (2020): 1657.
31. Al-Hazaa HM. "Physical inactivity in Saudi Arabia revisited: A systematic review of inactivity prevalence and perceived barriers to active living". *International Journal of Health Sciences* 12.6 (2018): 50.
32. Almutairi KM., *et al.* "Health promoting lifestyle of university students in Saudi Arabia: a cross-sectional assessment". *BMC Public Health* 18 (2018): 1-10.
33. Alkhateeb SA., *et al.* "Pattern of physical exercise practice among university students in the Kingdom of Saudi Arabia (before beginning and during college): a cross-sectional study". *BMC Public Health* 19 (2019): 1-7.
34. Aljehani N., *et al.* "Exploring female university Students' participation in physical activity in Saudi Arabia: a mixed-methods study". *Frontiers in Public Health* 10 (2022): 829296.
35. Al-Drees A., *et al.* "Physical activity and academic achievement among the medical students: A cross-sectional study". *Medical Teacher* 38 (2016): S66-S72.
36. Al Zahib YH and H Baarimah. "Physical activity profile among Saudi adults in Abha City, Saudi Arabia". *Middle East Journal of Family Medicine* 7.37 (2020): 10.5742.
37. Wu M., *et al.* "Effect of mid-adolescent dietary practices on eating behaviors and attitudes in adulthood". *Nutrients* 15.1 (2023): 225.
38. Gandhi AB. "Diet and Weight Management in Adolescent Girls". *The Journal of Obstetrics and Gynecology of India* 72.2 (2022): 175-177.
39. Al-Khamees NA. "Food habits of university nutrition students: pilot study". *Nutrition and Food Science* 39.5 (2009): 499-502.
40. Andere A and F Kyallo. "Nutritional status, nutrition knowledge and attitudes of students in Jomo Kenyatta University of Agriculture and Technology". in Scientific Conference Proceedings (2013).
41. Nasir JA and M Tahir. "Factors affecting nutritional attitudes among university adults". *Pakistan Journal of Commerce and Social Sciences (PJCSS)* 11.2 (2017): 644-652.
42. Taha AAAEA., *et al.* "Eating disorders among female students of Taif University, Saudi Arabia". *Archives of Iranian medicine* 21.3 (2018): 111-117.
43. Bizzari A and F Nasar. "Healthy lifestyle perceptions and practices among college students at Yanbu University College for Women in Saudi Arabia". *Open Health* 5.1 (2024): 20230036.
44. Raafat Abdelrazek R. "Assessment of the Nutritional, Health and Socioeconomic status of female students at Faculty of Science and Arts in Northern Border University, Saudi Arabia By". *Egyptian Journal of Nutrition* 36.3 (2021): 77-105.
45. Alshahrani NZ., *et al.* "Exploring university students' nutrition literacy in Saudi Arabia: A cross-sectional survey". *Frontiers in Nutrition* 11 (2020): 1425650.
46. Al-Qahtani MH. "Dietary habits of Saudi medical students at University of Dammam". *International Journal of Health Sciences* 10.3 (2016): 353.
47. Mohammed MA., *et al.* "Evaluation of nutritional status of foreign students at King Saud University, Kingdom of Saudi Arabia". *Public Health Nutrition* 24.1 (2021): 43-51.

48. Almutairi R, *et al.* "Eating disorders among adolescent female students in Jeddah, Saudi Arabia". *The Malaysian Journal of Medical Sciences: MJMS* 30.1 (2023): 185.
49. Choi J. "Impact of stress levels on eating behaviors among college students". *Nutrients* 12.5 (2020): 1241.
50. Aneesh M and R Roy. "Eating behavior and stress levels among college students". *Journal of Mental Health and Human Behaviour* 27.1 (2022): 60-64.
51. Abraham S, *et al.* "College students eating habits and knowledge of nutritional requirements". *Journal of Nutrition and Human Health* 2.1 (2018): 13-17.
52. Yun TC, *et al.* "Dietary habits and lifestyle practices among university students in Universiti Brunei Darussalam". *The Malaysian Journal of Medical Sciences: MJMS* 25.3 (2018): 56.
53. Buková A, *et al.* "Dietary habits of female university students in Eastern Slovakia in the context of sports activity". *Applied Sciences* 11.14 (2021): 6402.
54. Sprake E, *et al.* "Eating habits associated with body weight gain in female university students: a UK-based study of Slimming World members". *British Food Journal* 119.12 (2017): 2571-2582.
55. Sabur AM, *et al.* "Determinants of healthy food consumption and the effect of Saudi food related policies on the adult Saudi population, a national descriptive assessment 2019". *Current Research in Nutrition and Food Science Journal* 10.3 (2022): 1058- 1076.
56. Igbokwe U and Y John-Akinola. "Knowledge of menstrual disorders and health seeking behaviour among female undergraduate students of University of Ibadan, Nigeria". *Annals of Ibadan Postgraduate Medicine* 19.1 (2021): 40-48.
57. Alsaleem MA. "Dysmenorrhea, associated symptoms, and management among students at King Khalid University, Saudi Arabia: An exploratory study". *Journal of Family Medicine and Primary Care* 7.4 (2018): 769-774.
58. Abdel-Salam DM, *et al.* "Epidemiological aspects of dysmenorrhea among female students at Jof University, Saudi Arabia". *Middle East Fertility Society Journal* 23.4 (2018): 435-439.
59. Rafique N and MH Al-Sheikh. "Prevalence of menstrual problems and their association with psychological stress in young female students studying health sciences". *Saudi Medical Journal* 39.1 (2018): 67.
60. Sharma A, *et al.* "Problems related to menstruation and their effect on daily routine of students of a medical college in Delhi, India". *Asia Pacific Journal of Public Health* 20.3 (2008): 234-241.
61. Rigon F, *et al.* "Menstrual pattern and menstrual disorders among adolescents: an update of the Italian data". *Italian Journal of Pediatrics* 38 (2012): 1-8.
62. Hillen TI, *et al.* "Primary dysmenorrhea in young Western Australian women: prevalence, impact, and knowledge of treatment". *Journal of Adolescent Health* 25.1 (1999): 40-45.
63. Bakhsh H, *et al.* "Prevalence of dysmenorrhea among reproductive age group in Saudi Women". *BMC Women's Health* 22.1 (2022): 78.
64. Karout S, *et al.* "Prevalence, risk factors, and management practices of primary dysmenorrhea among young females". *BMC Women's Health* 21 (2021): 1-14.
65. Aref N, *et al.* "Frequency of different menstrual disorders among female medical students at Taif medical college". *World Journal of Medical Sciences* 12.2 (2015): 109- 114.
66. Tang Y, *et al.* "Is body mass index associated with irregular menstruation: a questionnaire study?". *BMC Women's Health* 20 (2020): 1-6.
67. Taheri R, *et al.* "Nutritional status and anthropometric indices in relation to menstrual disorders: A cross-sectional study". *Journal of Nutrition and Metabolism* 2020.1 (2020): 5980685.