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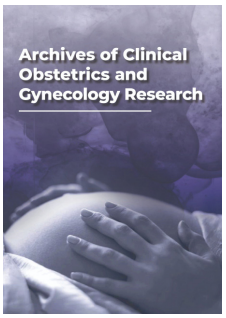

Exploring The Association Between Diet Quality And Premenstrual Syndrome Among Female College Students: A Cross-Sectional Study

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Keywords

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Abstract

Rationale: *Diet is one of the modifiable lifestyle factors associated with premenstrual syndrome (PMS), and college students are especially influenced by PMS. There is little research investigating the relationship between diet and PMS occurrence among female college students.*

Objective: This study aimed to examine the current status of PMS occurrence among female college students in the U.S. and the relationship of diet with the presence and severity of PMS.

Methods: *A cross-sectional design was conducted using convenience sampling methods. Inclusion criteria were females 18 years or older, and having regular menstrual cycles. An online survey was conducted during spring 2025 at a public university in northern New Jersey. The short Healthy Eating Index was used to assess diet quality as Needs Improvement or Poor. Participants' reports of PMS presence and severity were used to determine PMS occurrence and pattern. Descriptive statistics, binary logistic regression, and a paired sample t-test were performed.*

Findings: *A total of 369 students participated in the study. They were mostly undergraduate students (67%), had a mean age of 22.6 years, and 44% were White. The prevalence of PMS in the sample was 34%. In individuals with Needs Improvement diet, the risk of having PMS was reduced by 3.6% (RR=0.964, 95%CI [0.617, 1.506]), whereas the risk of experiencing severe PMS was 2.2 times higher (RR=2.224, 95%CI [0.712, 6.947]). Participants rated their PMS symptoms as less severe when their perceived diet quality was balanced than not (severity mean=2.33 vs. 3.49, p<.001). Participants rated their diet as balanced when PMS was less severe than when it was severe (diet quality mean=3.21 vs. 2.17, p<.001).*

Conclusions: *Future research should further investigate the relationship between diet and PMS by assessing diet across multiple menstrual cycles or through serial within-subject measurements.*

Introduction

Premenstrual Syndrome (PMS) refers to the physical, psychological, and behavioral discomfort or distress that women experience before menstruation [1]. Some common symptoms include headache, breast tenderness, food cravings, bloating, depression, irritability, anxiety, and mood swings [2]. The menstrual cycle is characterized by fluctuations in the ovarian hormones estradiol and progesterone, with an average cycle length of 28 days, starting from the first day of menstruation [3]. The menstrual cycle is generally divided into two phases: the follicular phase, lasting from the onset of menstruation until ovulation, and the luteal phase, lasting from ovulation until the beginning of the next menstruation [3]. PMS occurs during the luteal phase of one's menstrual cycle and typically resolves with the onset of menstruation [4].

While reported prevalence rates of PMS vary, a systematic review estimated a global prevalence of 48% among women of reproductive age [5]. Country comparisons reveal considerable differences, with the lowest prevalence observed in France (12%) and the highest in Iran (98%) [5]. In the United States (U.S.), the estimated prevalence is between 20% and 30% [6].

University students appear to be particularly affected by PMS. Akın et al. [7] reported that 80.5% of 1,101 female college students experienced at least one premenstrual symptom. Gudipally et al. [8] suggests that college and university students are a population highly vulnerable to PMS. A systematic review summarized that menstrual issues among female college students can lead to poor academic performance, missed classes, difficulties in social relationships, and overall poor health [9]. These findings highlight the

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need for further research to explore the current PMS trends and factors associated with PMS among college students.

Although the causes of PMS are not fully understood, growing evidence suggests that lifestyle factors, particularly diet, may influence the onset and severity of symptoms. Hashim et al. [10] suggested that the consumption of high-calorie, high-carbohydrate, high-fat, and high-salt foods was associated with an increased risk of developing physical symptoms of PMS [11]. They described that diet was one of the most significant and modifiable risk factors in the development of PMS [10,11]. Similarly, Isgin et al. [12] reported that individuals with PMS had lower Healthy Eating Index (HEI) scores of their diet—an indicator of overall diet quality ranging from 0 to 100—compared to those without PMS. They also found that individuals with poor diet quality had an approximately 3.33 times higher risk of experiencing PMS [12]. However, not all studies have found a consistent association. Some studies reported no significant differences in most dietary factors between individuals with and without PMS [13,14]. Research on the relationship between overall diet quality and PMS remains limited, particularly within U.S. populations. To fill this gap in literature, this study aimed to examine the current status of PMS occurrence among female college students in the U.S. and the relationship of diet with the presence and severity of PMS.

Methods

A cross-sectional study using convenience sampling was conducted to describe PMS prevalence and examine its relationship with dietary patterns at a public university in northern New Jersey. Inclusion criteria were female students aged 18 and older with regular menstrual cycles. A regular menstrual cycle was defined as one lasting 24-38 days [6] to ensure that individuals with consistent cycles were included in the study, which was necessary for identifying the luteal phase. Both the inclusion criteria and the cycle definition were stated in the recruitment materials.

Procedure

Data were collected from February to March 2025 via an online survey measuring diet quality, PMS presence, and symptom severity. Participants were recruited through paper flyers on campus and emails sent via the university listserv. The researcher also contacted academic departments to request help in promoting the study through departmental emails. Each recruitment material included a link to the survey.

Informed consent was presented on the first page of the survey, and participants could proceed only after indicating consent to participate. The research protocol was approved by the Institutional Review Board (IRB) of Montclair State University (IRB-FY23-24-3546).

Instruments

The online Qualtrics survey consisted of three sections: a demographic questionnaire, a short HEI survey to assess dietary habits, and a PMS questionnaire to inquire about the presence and severity of PMS symptoms.

Demographic Questionnaire

Demographic questions were based on previous studies that identified factors potentially related to the onset and severity of PMS [7,10,13,15-23]. Question items included age, self-reported height and weight, as well as information related to menstruation, lifestyle, and household income.

Short Healthy Eating Index (sHEI)

The sHEI, developed by Colby et al., [24] is designed to quickly evaluate diet quality by asking about the daily consumption frequency of 22 food items. The sHEI measures how well dietary patterns align with the Dietary Guidelines for Americans on a scale from 0 to 100. The sHEI has been validated with a strong correlation to 24-hour dietary recalls ($r = 0.79$) [24]. The internal consistency of the sHEI questionnaire was acceptable, with a Cronbach's alpha of 0.8 [25]. The HEI scores are categorized into three groups: Good (81 points or above), Needs Improvement (51-80 points), and Poor (below 51 points) [26].

Premenstrual symptom questions

This questionnaire was developed by the researcher, with items based on the American College of Obstetricians and Gynecologists (ACOG) diagnostic criteria for PMS [27], , and the Premenstrual Symptoms Screening Tool (PSST) [28]. Participants were first asked whether they experienced premenstrual symptoms before each period, whether the symptoms disappeared once menstruation began, and whether these symptoms had occurred during at least the past two cycles. If they answered "yes" to all three questions, they were then asked whether the symptoms affected their daily life: specifically, their schoolwork, daily activities, or social relationships. If they reported that the symptoms affected any of these aspects of daily life, they were classified into the PMS group. Otherwise, they were classified into the No PMS group.

Those in the PMS group identified the three most difficult symptoms to manage and rated each on a scale from 0 ("not at all severe") to 5 ("very severe").

They were also asked to assess their perceptions of diet quality and PMS severity. Specifically, they rated PMS severity under two dietary conditions—well-balanced vs. less balanced—and evaluated diet quality under two PMS conditions—severe vs. non-severe. These questions explored perceived bidirectional relationships between diet and PMS. The scale used showed acceptable internal consistency (Cronbach's alpha = 0.7) [25].

Data Analysis

Demographic Analysis

Data analysis was performed using IBM® SPSS Statistics (version 28.0.1.1). Descriptive statistics summarized participant demographics. Height and weight were used to calculate body mass index (BMI). Differences between the PMS and No PMS groups were examined using independent samples t-tests, Pearson's Chi-Square tests, and Fisher-Freeman-Halton Exact tests. The t-tests compared means of continuous variables such as age, BMI, and total sHEI scores. Chi-Square tests assessed differences in categorical variables, including race, academic year, major, income, pregnancy history, oral contraceptive use, exercise, sleep hours, alcohol use, and tobacco use. When Chi-Square assumptions were not met, Fisher-Freeman-Halton tests were used, as with marital and employment status.

Relationship Between Diet Quality and the Presence of PMS

The relationship between PMS presence and diet quality was examined using an independent sample t-test and binary logistic regression. The t-test compared mean total sHEI scores between the PMS and No PMS groups. In the logistic regression, both odds ratios (ORs) and adjusted ORs were calculated. PMS status was treated as a categorical variable, while sHEI scores were analyzed both categorically and continuously. For

the categorical analysis, diet quality was dichotomized into "Poor" and "Needs Improvement," as no participants scored 81 or higher, which is the threshold for a "Good" diet. In the continuous analysis, total sHEI scores were used to assess whether diet quality was significantly associated with PMS odds. Covariates included in the adjusted model were age, BMI, academic year, sleep duration, alcohol use, tobacco use, and regular exercise. Academic year and sleep duration were included because significant differences were observed between the PMS and No PMS groups. Age [29], BMI [21,29], alcohol consumption [30], tobacco use [31], and regular exercise [32] were included based on previous literature, as they are lifestyle factors that may be associated with the presence of PMS. The primary outcome of interest was the presence of PMS, with Poor diet being the exposure variable.

Relationship Between Diet Quality and PMS Severity

An overall PMS severity score was calculated by averaging the ratings of up to three selected symptoms per participant. Severity was categorized based on the sample's score distribution, with a median of 3.36. Although the scale midpoint is 2.5, the higher median led to the following classification: scores < 2.5 as Mild, 2.5-3.36 as Moderate, and > 3.36 as Severe. To examine the association between diet quality and PMS severity, binary logistic regression was conducted. This analysis estimated ORs and adjusted ORs for experiencing severe PMS among those with a Poor diet. PMS severity was categorized as either Mild or Severe. Diet quality was analyzed both categorically and continuously. For the categorical analysis, sHEI scores were dichotomized into Needs Improvement and Poor. In the continuous analysis, total sHEI scores were used to assess whether the association remained significant across the full score range. Adjusted models included age, BMI, academic year, sleep duration, alcohol use, tobacco use, and regular exercise [21,29-32].

Individuals' perceptions of diet quality and severity of PMS

To assess how individuals perceive the relationship between diet quality and PMS severity, a paired sample t-test was performed. This test compared the mean scores of PMS severity under two different diet conditions and the mean scores of diet quality assuming two different levels of PMS severity. The results provided supplemental information on how participants' perceptions of the relationship between diet quality and PMS severity aligned with their actual dietary practices. A P-value of < .05 was considered statistically significant for all statistical analysis tests.

Results

Demographic Characteristics

A total of 507 female students participated in this study, with 369 providing valid responses that were analyzed (completion rate = 72.8%). The prevalence of PMS among female college students in this study population was 33.6%. The mean age of participants was 23 years. Among the total sample, 44.1% identified as White, the majority were undergraduate students (67.4%), academic majors were nearly evenly distributed, and most participants (67.4%) were employed. Most of the demographic variables did not differ significantly between the PMS and No PMS groups, except for age, academic year, and sleep duration (See Table 1).

Table 1. *Baseline demographic characteristics among a sample of female college students*

Characteristics	Total (n=369)	PMS (n=124)	No PMS (n=245)	P
	← mean (SD) →			
Age (years)	23 (5)	23 (5)	22 (5)	.020[a]
BMI1	25.7 (5.9)	25.6 (6.2)	25.7 (5.8)	.872[a]
Total sHEI score	47.62 (9.84)	47.12 (11.50)	47.88 (8.90)	.520[a]
	← n (%) →			
Race				.170[b]
White	161 (44.1)	57 (46.3)	104 (43.0)	
Black	36 (9.9)	8 (6.5)	28 (11.6)	
Hispanic/Latino	101 (27.7)	30 (24.4)	71 (29.3)	
Asian	48 (13.2)	18 (14.6)	30 (12.4)	
Other	19 (5.2)	10 (8.1)	9 (3.7)	
Academic year				.002[b]
Freshman	51 (13.8)	10 (8.1)	41 (16.8)	
Sophomore	62 (16.8)	17 (13.7)	45 (18.4)	
Junior	72 (19.5)	18 (14.5)	54 (22.1)	
Senior	64 (17.3)	24 (19.4)	40 (16.4)	
Graduate	119 (32.2)	55 (44.4)	64 (26.2)	
Major				.190[b]
Arts and Humanities	68 (18.8)	22 (17.9)	46 (19.3)	
Business	26 (7.2)	9 (7.3)	17 (7.1)	
Health	61 (16.9)	17 (13.8)	44 (18.5)	
Social Sciences	96 (26.6)	31 (25.2)	65 (27.3)	
STEM	48 (13.3)	14 (11.4)	34 (14.3)	
Other	62 (17.2)	30 (24.4)	32 (13.4)	

Characteristics	Total (n=369)	PMS (n=124)	No PMS (n=245)	P
Marital status				
Single	313 (86.0)	105 (84.7)	208 (86.7)	
Married	33 (9.1)	13 (10.5)	20 (8.3)	.201[c]
Divorced/Separated	2 (0.5)	2 (1.6)	0 (0.0)	
Other	16 (4.4)	4 (3.2)	12 (5.0)	
Working status				
Full-time employed	53 (14.6)	20 (16.4)	33 (13.8)	
Part-time employed	191 (52.8)	64 (52.5)	127 (52.9)	.723[c]
Not employed	111 (30.7)	37 (30.3)	74 (30.8)	
Other	7 (1.9)	1 (0.8)	6 (2.5)	
Household income				
< $15,000	83 (27.7)	21 (20.6)	62 (31.3)	
$15,000 to $49,999	81 (27.0)	27 (26.5)	54 (27.3)	.187[b]
$50,000 to $149,999	114 (38.0)	45 (44.1)	69 (34.8)	
> $149,999	22 (7.3)	9 (8.8)	13 (6.6)	
Pregnancy history				
Yes	35 (9.6)	12 (9.8)	23 (9.5)	.919[b]
No	329 (90.4)	110 (90.2)	219 (90.5)	
Use of oral contraceptives				
Yes	86 (23.6)	27 (21.8)	59 (24.5)	.564[b]
No	279 (76.4)	97 (78.2)	182 (75.5)	
Regular exercise				
Yes	178 (49.3)	61 (49.6)	117 (49.2)	.938[b]
No	183 (50.7)	62 (50.4)	121 (50.8)	
Sleep hours				
< 7 hours	145 (39.4)	38 (30.6)	107 (43.9)	.010[b]
7 to 9 hours	212 (57.6)	79 (63.7)	133 (54.5)	
> 9 hours	11 (3.0)	7 (5.6)	4 (1.6)	
Daily alcohol consumption				
Yes	107 (29.5)	37 (30.3)	70 (29.0)	.800[b]
No	256 (70.5)	85 (69.7)	171 (71.0)	
Tobacco use status				
Never	325 (89.8)	109 (89.3)	216 (90.0)	.790[b]
Former User	26 (7.2)	10 (8.2)	16 (6.7)	
Current User	11 (3.0)	3 (2.5)	8 (3.3)	

(a) Independent sample t-test, (b) Pearson Chi Square test, and (c) Fisher-Freeman-Halton Exact test were performed.
1. BMI was calculated from height and weight.
Abbreviations: BMI, body mass index; SD, Standard deviation; PMS, premenstrual syndrome; STEM, Science, Technology, Engineering, and Mathematics

Association between diet quality and the presence of PMS

The total mean sHEI scores were similar regardless of PMS presence; 47.12 in PMS group vs. 47.88 in No PMS group (P = .52). The Poor diet group had 13% higher odds of having PMS, adjusted OR = 1.13 (95% CI 0.69 to 1.87, P = .63) compared to the Needs Improvement group. When total sHEI scores were treated as a continuous variable in the analysis, the odds decreased by 1% for each 1-point increase in the sHEI score, adjusted OR = 0.99 (95% CI 0.96 to 1.01, P = .21).

On the other hand, the poor diet group had 68% lower odds of experiencing severe PMS, adjusted OR = 0.32 (95% CI 0.06 to 1.67, P = .18). A separate logistic regression analysis using the total sHEI score as a continuous variable indicated that the odds increase by 5% for each 1-point increase in the sHEI score, adjusted OR = 1.05 (95% CI 0.96 to 1.15, P = .26) Although these findings were not statistically significant, they showed a direction in the continuum of the relationships (See Table 2).

Individuals' perceived PMS severity based on diet quality

Participants rated their PMS symptom more severe when they perceived their diet as unbalanced (severity mean = 3.49) compared to well-balanced (severity mean = 2.33) (P < .001). Additionally, participants perceived their diet quality to be better during times when PMS symptoms were less severe (diet quality mean = 3.21) compared to when the symptoms were severe (diet quality mean = 2.17) (P < .001) (See Table 3).

Discussion

This study contributes to the limited body of research that has investigated the prevalence of PMS and its association with diet quality among U.S. female college students using the validated sHEI scores. The prevalence of PMS in this sample population indicates that approximately one in three participants experienced PMS. The prevalence observed in this study aligns closely with the reported 20% to 30% prevalence of PMS in the U.S [2].

Table 2. *The odds ratio of having PMS (N=369)/experiencing severe PMS (n=80) based on diet quality among a sample of female college students (N=369)*

	PMS (n=124)	No PMS (n=245)	OR [95% CI]a	P	AOR [95% CI]b	P
Diet Quality, n (%)						
Poor	78 (62.9)	152 (62.0)	1.037 [0.664, 1.621]	0.872	1.133 [0.686, 1.872]	0.625
Need Improvement	46 (37.1)	93 (38.0)	-	-	-	-
	Mild PMS (n=124)	**Severe PMS (n=245)**	**OR [95% CI]c**	**P**	**AOR [95% CI]d**	**P**
Diet Quality, n (%)						
Poor	14 (73.7)	34 (55.7)	0.450 [0.144, 1.405]	0.169	0.320 [0.061, 1.674]	0.177
Need Improvement	5 (26.3)	27 (44.3)	-	-	-	-

Binary logistic regression was performed.
a. Model $\chi^2(1) = 471.10$, Cox & Snell $R^2 = .000$, Nagelkerke $R^2 = .000$.
b. Model $\chi^2(8) = 414.27$, Cox & Snell $R^2 = .06$, Nagelkerke $R^2 = .09$.
c. Model $\chi^2(1) = 85.69$, Cox & Snell $R^2 = .03$, Nagelkerke $R^2 = .04$.
d. Model $\chi^2(8) = 53.40$, Cox & Snell $R^2 = .24$, Nagelkerke $R^2 = .38$.
Adjusted covariates are: age, BMI, academic year, sleep hours, alcohol consumption, tobacco use status, and regular exercise.
Abbreviations: OR, odds ratio; AOR, adjusted odds ratio; 95% CI, 95% confidence interval.

Table 3. *Individuals' perceived PMS severity and diet quality among a sample of female college students (n=143)*

Variable	Mean (SD)	t-value	df	P
PMS severity	When diet is well balanced	-10.992	142	< .001
	2.33 (1.17)			
	When diet is not well- balanced			
	3.49 (1.05)			
Diet quality	When PMS is severe	-8.833	139	< .001
	2.17 (1.16)			
	When PMS is not severe			
	3.21 (1.06)			
Paired sample t-test was performed.				

The results showed a contrasting pattern in the relationship between PMS and diet quality. While individuals with poorer diet quality tended to have higher odds of experiencing PMS, there was a trend toward lower odds of experiencing severe PMS. This seemingly inconsistent trend suggests that individuals with more severe PMS symptoms may be more attentive to their dietary habits compared to those with milder symptoms. Supporting this, Abu et al. [22] reported that individuals who consumed herbal tea, often used as a symptom management strategy, experienced more severe PMS symptoms than those who did not. Moreover, herbal remedies and nutritional supplements reduce PMS symptom scores across various studies [33]. These imply that individuals with severe PMS may actively seek dietary or supplement-based strategies to alleviate their symptoms. As a result, their efforts to modify diet may confound the relationship between baseline diet quality and PMS severity, potentially contributing to the findings in this study.

While age, academic year, and sleep duration were included as demographic variables in this study, these factors significantly differed between the PMS and No PMS groups, indicating the need for further research as risk factors. Participants with PMS were, on average, older than those without. Balaha et al. [34] supports this, showing that older students more frequently experience PMS. Freeman et al. [35] also suggested that PMS severity increases with age, though it noted that late adolescence is a common onset period. Future research should clarify the typical age of PMS onset, its initial severity, and symptom progression over time.

PMS prevalence also increased with the academic year. Prior studies found that female college students experienced more PMS as they advanced [36], likely due to increased academic stress. This trend may also be reflected in this study sample. In addition to academic stress, another possible contributing factor in this study is that students in higher academic years may have greater self-awareness and symptom recognition, which could lead to increased reporting of PMS.

Sleep duration also differed, with participants in the PMS group tending to sleep more. Previous studies linked PMS to poor sleep quality, disturbances, and longer sleep latency [38,39]. While longer sleep duration was not specifically reported, it may reflect attempts to compensate for poor rest. Future studies should examine both sleep duration and quality.

The similarity in sHEI scores between individuals with and without PMS can be due to the overall poor diet quality of the study sample, the uneven number of participants across the

groups, and variations in diet assessment tools compared to other studies. The overall diet quality among the entire sample was categorized as poor. The total sHEI scores in both PMS and No PMS groups were lower than the national average HEI score of 55.3 reported in the 2018 NHANES data for U.S. adults aged 19 to 59 years.[40] This suggests that participants, regardless of PMS status, generally had poor dietary patterns. In addition, the adherence to dietary recommendations follows a U-shaped trend across the lifespan: lowest during ages 14 to 18, then gradually improving in adulthood [41]. Given that this study included participants aged 18 and older, it was plausible that younger individuals—particularly those transitioning from adolescence to early adulthood—demonstrated poorer overall diet quality.

This study has several limitations. First, although the presence and severity of PMS were assessed using a questionnaire based on the ACOG diagnostic recommendations and PSST [27,28], it may not have fully captured an accurate understanding of each individual's symptoms and severity. Second, because this study employed a cross-sectional design, data were collected at a single point in time. Participants' diet and health conditions may have varied depending on the phase of their menstrual cycle when they completed the survey. Third, although regular menstruation was defined as cycles occurring at intervals of 24 to 38 days [6], the consistency of participants' menstrual cycles over time was not assessed, which may have influenced their symptom reporting during the luteal phase. Finally, while the use of the sHEI survey facilitated a feasible dietary assessment among participants, it assigns uniform scores for certain nutrients to all female participants regardless of their actual intake and does not account for total caloric consumption. Future studies should take these factors into consideration to enable a more accurate and comprehensive evaluation of diet quality.

Despite these limitations, this study is among the few that evaluated the prevalence of PMS among female college students in the U.S. and explored its relationship with diet quality. Future research should employ more rigorous study designs to further investigate these associations. Studies on the relationship between diet and PMS should consider the menstrual cycle phase as an important variable. A more appropriate design could involve a within-subjects approach, assessing diet quality during both the luteal and follicular phases within the same participants. This approach would facilitate the comparison of dietary patterns across different menstrual phases and enhance understanding of the role diet plays in PMS severity.

Conclusion

PMS can significantly impact the quality of life over the long term. Hence, understanding its relationship with diet and lifestyle factors is crucial for improving the health of students and women of reproductive age. Gaining deeper insights into how diet and other lifestyle factors influence PMS could help develop strategies to reduce the onset and severity of the symptoms.

Conflicts of Interest

The authors report there are no competing interests to declare.

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