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Interrelation Between Diet, Nutritional Antioxidants and Negative mood during Menstrual Period Among University Students: A Cross- Sectional Study

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[AA]Conception and design, Collection and assembly of data, [RI]Analysis and interpretation of the data, Statistical expertise, TF, [AA] Final approval and guarantor of the article

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A B S T R A C T

Background: A woman's diet can have a significant effect on her menstrual cycle and overall mood. Many women experience negative moods, such as depression, anxiety, and irritability during their menstrual period. These mood changes are often attributed to hormonal fluctuations that occur during this time. Extensive research has suggested that diet and nutritional antioxidants may also play a role in these mood changes.

Objective: To determine the prevalence and severity of negative mood and its relationship with diet during menstruation among female university students.

Methodology: A cross-sectional non- Probability convenient sampling survey trough self-administered questionnaire was carried out that encompasses demographics, food frequency questionnaire (FFQ), menstrual distress questionnaire (MDQ). Multiple logistic regression analysis and descriptive statistics were performed.

Results: The total sample number of study population was 250 among which only 245 further proceeded for analysis. The mean and standard deviation of variable age of participants were 20.36 + 1.47 years, the average cycle length was 27.81 + 1.00. The average weight of participants was 59.8 + 11.9. The average height was 164.3 + 7.2 cm. The mean BMI of partakers was 24.1 + 4.8 kg/m2. The consumption of carbonated beverages, tea and coffee was positively associated with negative mood during the menstrual phase, (p = 0.0443), in addition to that the consumption of fresh fruits during the premenstrual phase (p = 0.0429) was negatively associated with negative mood.

Conclusion: The results of our study indicate that negative mood was significantly associated with soft drinks, caffeinated drinks and fast food among university females.

Keywords: Negative Mood, Dietary Behavior, Nutritional Antioxidants, Female Students, Menstrual Cycle

Introduction

Menses is a Latin word that means "months" in English. The Latin verb "menstrualis," which means "monthly," is where the word "menstruation" originates from, as does the ancient French word "menstrual," which means "periodic" especially "of or having regular courses. Academic performance, physical condition, behavioral pattern, nutrition, exercise, mood, and sleep pattern are just a few of the aspects of daily life that are impacted by the menstrual cycle. “Menstruation is a regular monthly pelvic blood loss that is a normal aspect of a woman's existence. The body of a woman gets ready for pregnancy every month. The uterus eliminates its lining if there is no pregnancy. Blood as well as tissue from the uterus can be found in some of the menstrual blood. Through the genital area, it leaves the body.[1]

A normal menstrual cycle can be maintained by eating a healthy, balanced diet that includes fruits, vegetables, sources of vitamins and minerals, dairy products, and seafood. This may help prevent painful periods that can develop as a result of dietary changes or a diet low in nutrients. People's dietary habits determine their nutritional state. Obesity & anorexia nervosa are just two examples of the factors that can be minimized by following a planned diet.[2]

Dieting results in a lack of calories consumed, which creates an energy imbalance that can change menstrual cycles and, in turn, cause a number of health problems in later life. Overweight is a significant threat agent for insulin resistance as well as hyperlipidemia, both of which may lead to the onset of polycystic ovarian disease and lower quality of life. Negative moods can be caused by a variety of factors, including drug use, aberrant endocrine secretion, social and psychological stress from daily living, and others. Neurotransmitters including dopamine, serotonin, and endorphin are responsible for the enthusiasm transmission on emotional circuits. More than 400 biological processes are impacted by the hormone estrogen, including the modulation of neurotransmitters in the brain.[3]

The role of balanced nutrition is vital in shaping our cognitive and behavioral functioning as our food choices directly impact cognition, memory, capacity and emotion. Many studies have shown that the food we consume have an impact on chemical composition of our brain. The effect of carbohydrates consumption on mode have been extensively studied with research reporting both mood improvement and declines the induction of carbohydrates.[4] Furthermore, in many individuals, the consumption of high carbohydrate or high fat foods can lead to the negative mood.

Antioxidant-rich meals may help to lessen the unfavorable mood swings. Caffeine and/or sugar are present in tea, coffee, and fizzy beverages. Two of the most widely used psychoactive substances worldwide are caffeine and sugar. They frequently have beneficial consequences on thinking, which may motivate the CNS and stimulate the cerebral cortex's bulbar, nerve center, motor center and spinal cord center. They may further stimulate nerves, bring about a state of consciousness, relieve fatigue, and boost systolic function, giving people a joyful or even happy feeling.[5] In general, antioxidants like chlorogenic acid and catechins are abundant in both tea and coffee.

Theanine, whichever affect an amount of neurotransmitter systems, is another component of tea. Theanine has a direct effect on the attentiveness and physiological function of serotonin, as well as the release of dopamine. A peak concentration of these brain chemicals is thought to increase good feelings because they can energize the nervous system, allowing people to ease as well as experience joy. Dopamine and serotonin are crucial for regulating attitude and moods. According to our study, consumption of carbonated beverages, tea as well as coffee during the menstrual discharge was considerably excessive in the group with higher bleak mood scores than it was in the group with lower bleak mood scores, which suggested that bleak emotional state was positively correlated with these drinks. According to these findings, university-bound female students who are in a bad emotional state are more inclined to drink frizzy drinks, tea as well as coffee to boost their mood.[6]

When women are younger, anxiety and depression can affect their menstrual cycles. In addition to stiffness, fatigue, backaches, bloated abdomens, as well as painful breasts, monthly suffering has been interlinked with other signs and symptoms. Research has revealed that menstrual suffering affects women's daily actions, as well as their reproductive and emotional health. Premenstrual syndrome, which includes sensations like mild convulsions and tiredness, is one of the many irritating symptoms that usually go with menstrual cycles. Conversely, depending on each woman's way of life, health, diet, and other circumstances, the intensity of these symptoms varies from one woman to the next. Drinking, smoking and an increase in starvation have all been reported by women with menstrual-related difficulties[7]. A sustained high-fat diet has also been linked to an increase in progesterone and luteinizing hormone at the same time.

Methodology

A cross-sectional non- Probability convenient sampling survey was carried out between a sample of 250 undergraduate students of Riphah International university Lahore, aged 19-25 years old, between March 2023 till June 2023. Students were handed over a questionnaire which was pretested and validated closed-ended (static) questionnaire. After finishing the questionnaire, participants had their anthropometric measurements taken. With light clothing on and bare feet, the weight (in kilograms) was carefully measured on a digital scale, and the height (in centimeters) was measured with a portable stadiometer leaning up against a wall. The participant's height and weight were used to calculate their BMI (in kg/m2) in order to ascertain their current weight status. Based on their BMI, participants were categorized into five groups: severely underweight (BMI ≤ 18.4), underweight (BMI 18.5 kg/m2), healthy weight (BMI 18.5-24.9 kg/m2), overweight (BMI 25.0-29.9 kg/m2), and obese (BMI 30.0 kg/m2). Female students between the ages of 19 and 25 who are able to understand English, have regular periods, have not used mood-regulating medications or supplements within the previous three months, do not have depression or any other emotional disorders, and who agree to provide informed consent were included in the study. Students below the age of 18 and above 25, who have hormonal problems or PCOS, irregular periods, fibroids, cysts, endometriosis, or any other chronic illness, who have used any medication or health aid for mood regulation within the last three months, who have depression or any other emotional disorder, or who refuse to provide informed consent were

excluded. Two separate teams distributed and collected the self-administered survey on the spot. Age, university, degree program, semester, marital status, number of children if married, cycle length, age at menarche, socio-economic status, residential status, height, weight, BMI were all included in this section of the questionnaire.

For evaluating negative mood, the Moos-developed[8] and -improved MDQ was used. The MDQ was made up of nine scales with a total of 51 items, including questions about pain, concentration, behavior change, autonomic reactions, water retention, negative affect, arousal, control and dietary habits. Mood swings, depression, tension, crying, anxiety, irritability, loneliness and restlessness were the other eight symptoms under the scale of negative affect. A four-pointer scale, which ranges from no symptom to a severe symptom, was used to rate the degree of symptoms of participants. The negative mood is heavier if the overall score on the scale of negative affect is higher and vice versa. Data from the survey was subjected to test-retest reliabilities. As Supplementary Material, a sample questionnaire was offered.

Using the FFQ, dietary behavior was evaluated. Food items from 9 food groups mainly starch, meat, dairy, vegetables, fruits, fats, sweets, beverages and fried & fast foods were included. Six categories were created based on how frequently each food category was consumed previously: less than once per week, once per week, once, 2-3 times per week, 4-6 times per week, once per day, and twice or more per day. As Supplementary Material, a sample questionnaire was provided.

The scale score and food consumption frequency were expressed as mean ± standard deviation. Participants were divided into low and high-scoring groups based on the median negative affect scale score. A nonparametric ANOVA tested differences in weekly food consumption ratios between the groups. Multivariate logistic regression analyzed the relationship between negative affect and food consumption, adjusting for age, height, and weight, with negative affect as the dependent variable and food consumption frequencies as independent variables. Odds ratios (ORs) were calculated. Statistical analyses were performed using Microsoft Word, Excel, and SPSS 27.0, with p-values < 0.05 considered significant.

Results

The total sample number of study population was 250 among which only 245 further proceeded for analysis with a percentage of participation at 98.0%. 5 samples were excluded due to missing data in questionnaire or wrong filling of required data with a 2 % exclusion rate. The questionnaire's reliability rate after running Cronbach's alpha was 98.1% with total number of 198 variables. The variables were separated into groups under demographical features, anthropometric measurements, food frequency questionnaire (FFQ) and menstrual distress questionnaire (MDQ).

The demographic characteristics of the participants are summarized in Table I.

Table I: Descriptive Statistics of Demographic Features.

Demographic features	Mean ±SD
Age 19-25 (years)	20.36±1.47
Cycle length 23 to 35 days	27.81±1.00
Weight (kg) 40 to 90 kg	59.8±11.9
Height (cm) 120 to 190 cm	164.3±7.2
BMI (kg/m^2)	24.1±4.8

Mean, standard deviation and correlation of scores of the negative affect scale for the premenstrual and menstrual phases of the menstrual cycle were displayed (Table II). The negative affect scale differed significantly among the premenstrual and menstrual phases ($p < 0.0002$).

Table II: Scores of Negative Affect Scale of Premenstrual and Menstrual Phase.

Phases	Mean ±SD	Pearson Correlation	p-value
Premenstrual	4.13±4.97	0.83**	0.0002
Menstrual	5.43±6.94	0.84**	0.0002

**. Correlation is significant at the 0.01 level (2-tailed).

The negative affect scale's Cronbach alpha coefficient was 0.84 for both premenstrual and menstrual phases, with correlations in the range from 0.80 to 0.85 for each item, yielding an average correlation coefficient of 0.83 (Table III)

52% participants claimed to have pain in premenstrual phase which increased rapidly at 87% during menstrual phase. Loneliness, mood swings and depression which were part of negative scale affect were noticed to be greatly increased in menstrual phase (93%) in comparison to premenstrual phase (32%). Concentration and autonomic reactions were least affected. The partakers were categorized into low-score and high-score based on their median of negative affect scale score (Table IV).

Table IV also contains the outcomes of the nonparametric ANOVA. During the menstrual phase, the high-score group consumed more beverages (2.86 $\pm$ 1.07) like tea, coffee and beverages (e.g., Coke and Sprite), sweets (3.03 $\pm$ 1.98) and fried food (2.03 $\pm$ 0.99) than the low-score group (1.08 $\pm$ 1.59), (1.96 $\pm$ 1.95) and (1.10 $\pm$ 1.42) respectively ($p < 0.05$). Similarly, the high-score group consumed more fresh fruit (5.23 $\pm$ 3.89) (e.g., bananas, grapes and dates) and vegetables (11.45 $\pm$ 4.02) than the low-score group (3.87 $\pm$ 2.93), (7.99 $\pm$ 3.98) during the premenstrual phase ($p < 0.05$).

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Table III: Correlations of each Variable in Negative Affect Scale for both Premenstrual and Menstrual Phase

Premenstrual phase		Menstrual phase							
		Crying	Loneliness	Anxiety	Restlessness	Irritability	Mood Swings	Depression	Tension
Crying	Correlation	1	.83**	.82**	.82**	.85**	.83**	.84**	.85**
	p-value		.0002	.0002	.0002	.0002	.0002	.0002	.0002
Loneliness	Correlation	.83**	1	.83**	.81**	.83**	.84**	.83**	.84**
	p-value	.0002		.0002	.0002	.0002	.0002	.0002	.0002
Anxiety	Correlation	.82**	.83**	1	.85**	.85**	.82**	.84**	.84**
	p-value	.0002	.0002		.0002	.0002	.0002	.0002	.0002
Restlessness	Correlation	.82**	.81**	.85**	1	.80**	.84**	.80**	.82**
	p-value	.0002	.0002	.0002		.0002	.0002	.0002	.0002
Irritability	Correlation	.85**	.83**	.86**	.80**	1	.85**	.83**	.85**
	p-value	.0002	.0002	.00002	.0002		.0002	.0002	.0002
Mood Swings	Correlation	.83**	.85**	.82**	.84**	.85**	1	.85**	.85**
	p-value	.0002	.0002	.0002	.0002	.0002		.0002	.0002
Depression	Correlation	.85**	.83**	.84**	.80**	.83**	.85**	1	.80**
	p-value	.0002	.0002	.0002	.0002	.0002	.0002		.0002
Tension	Correlation	.85**	.84**	.84**	.82**	.85**	.85**	.80**	1
	p-value	.0002	.0002	.0002	.0002	.0002	.0002	.0002	

**. Correlation is significant at the 0.01 level (2-tailed).

Table IV: Food consumption frequencies of the low-score and high-score groups during premenstrual and menstrual phase

Food Groups	Premenstrual Phase		Menstrual Phase	
	Low-Score Group Mean ±SD	Low-Score Group Mean ±SD	High-Score Group Mean ±SD	High-Score Group Mean ±SD
Starch	14.97 ± 2.98	15.21 ± 4.06	13.20 ± 4.10	16.34 ± 4.1
Meat	12.01 ± 1.99	11.09 ± 3.58	10.13 ± 3.02	11.67± 3.57
Milk & Milk products	3.01 ± 1.96	3.07 ± 1.98	2.97 ± 3.12	3.56 ± 4.11
Vegetables	11.45 ± 4.02	11.28 ± 2.98	9.89 ± 4.01	7.99 ± 3.98
Fruits	5.23 ± 3.89	5.01 ± 3.59	3.99 ± 2.97	3.87 ± 2.93
Fats	2.02 ± 1.99	1.67 ± 1.98	1.99 ± 2.96	2.14 ± 3.34
Sweets	2.50± 3.03	1.96 ± 1.95	3.03 ± 1.98	3.23± 3.04
Beverages	2.19 ± 3.01	1.08 ± 1.59	2.86 ± 1.07	1.78± 2.23
Fried & Fast food	1.78 ± 3.16	1.10 ± 1.42	2.03 ± 0.99	1.32± 1.67

Table V shows the results of the logistic regression analysis. Negative mood was positively correlated to the intake of beverages (tea, coffee, fizzy drinks) [p = 0.04, OR = 1.19] sweets (p = 0.04, OR = 1.09) and fast & fried food (p = 0.03, OR = 0.96) during the menstrual phase and with fresh fruits (bananas, grapes and dates) [p = 0.03, OR = 1.32] and vegetables (p = 0.04, OR = 2.25) during the premenstrual phase.

Discussion

The mean and standard deviation of variable age of participants were 20.36 ± 1.47 years, the average cycle length was 27.81 ± 1.007 days. The average weight of participants was 59.8 ± 11.9 kg, average height was is 164.3 ± 7.2 cm and mean BMI was 24.1 ± 4.8 kg/m2. The participating female student's average BMI was within the normal range. However, no significance correlations between anthropometric variables and negative mood were discovered. This conclusion is consistent with those reached by Sadler and co-workers in a cross-sectional study of 974 females in the UK [9] and with a latest conclusion reached by Isgin-Atici and teammates in Turkey.[10] This is in contrast to studies in adult females from Pakistan, Korea, Iran, and the United States that found that high BMI was an element of danger for high prevalence of irregular menstruation.[11] However, given that our participants' average BMI fell within the normal range and that the fewest persons had a high BMI, this can be explained.

52% participants claimed to have pain in premenstrual phase which increased rapidly at 87% during menstrual phase. 23% have more concentration problems in menstrual phase as compared to premenstrual phase (10%). Change in behavior was also observed increasing in menstrual phase (58%) than in premenstrual phase (37%). Similar patterns were observed in other scales as well. Loneliness, mood swings and depression which were part of negative scale affect were noticed to be greatly increased in menstrual phase (98%) in comparison to premenstrual phase (32%). (Figure 1)

The most frequent severe symptoms described in the current study were back, muscle and joint pain, along with anger, depression, irritability and tension. The behavioral problems

(more particularly, PMS symptoms interfering with work/school) were the least frequent severe symptoms. One of the least frequent physical complaints was tenderness or soreness in the breasts. These results go against claims that breast pain was one of the most often complained symptoms for females with PMS [12] and support another research that found it to be the least common symptom.[13,14] Breast pain's low reporting in the current study can be described by the context that somatic symptoms are frequently linked to higher levels of inflammation.[15]

Table V: Logistic regression analysis between negative affect scale and dietary intake frequencies.

Food Groups	Premenstrual Phase			Menstrual phase		
	OR *	95% CI	*p*	OR *	95% CI	*P*
Starch	2.04	1.02–1.34	0.78	1.00	1.23–1.22	0.07
Meat	1.54	2.02–1.35	0.84	1.01	1.12–1.34	0.07
Vegetables	1.32	1.02–1.42	0.03*	1.00	1.00–1.42	0.09
Fruit	2.25	1.12–1.55	0.04*	1.00	1.01–1.45	0.10
Beverages	1.62	1.09–1.78	0.06	1.19	1.10–1.89	0.04*
Milk and Milk products	1.23	1.07–1.47	0.83	1.04	1.09–1.43	0.07
Fats	1.12	1.02–1.51	0.05	0.89	1.21–1.34	0.03*
Sweets	1.32	1.23–1.86	0.06	1.09	1.07–2.04	0.04*
Fried food	1.12	0.91–1.68	0.02*	0.96	1.18–2.11	0.03*

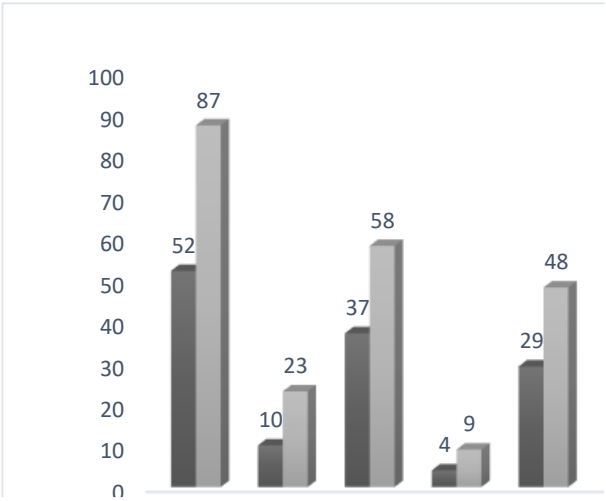

Figure 1. Percentage Distribution of each scale in Premenstrual and Menstrual phase.

Among most often reported physical discomforts in questioned women of the current study is abdominal pain, which is consistent with the overwhelming majority of female participants in many prior studies.[16-19] This conclusion, however, conflicts with latest research on pertinent college going students from China [20] and Indian high school female students.[17] The variance in food and lifestyle practices, as well as the coping mechanisms used by the surveyed females before and throughout their menstrual cycles, could account for this difference in the types of claimed physical problems.

Due to their menstrual cycle, many of the female students in the current study had a bad mood. According to Chinese and international research findings[10], the scores of negative moods were substantially greater throughout the menstrual phase compared to the premenstrual phases.

In the study during the menstrual phase, the high-score group consumed more beverages (2.86 $\pm$ 1.07) like tea, coffee and fizzy drinks (e.g., Coke and Sprite), sweets (3.03 $\pm$ 1.98) and fried food (2.03 $\pm$ 0.99) than the low-score group (1.08 $\pm$ 1.59), (1.96 $\pm$ 1.95) and (1.10 $\pm$ 1.42) respectively ($p < 0.05$), which demonstrated a positive correlation between consumption of these food groups and negative mood. With their consumption amount significantly greater in the menstrual phase in high-than-low-score negative mood group suggest that more depressed female university students are more prone to consume tea, coffee, and fizzy drinks along with sweets and fried foods to energize their nervous system and lift their spirits.

Dates are high in vitamin C and include 18 different kinds of important amino acids. Vitamins C and B6 both have antioxidant effects. Some amino acids have the ability to control neurotransmitters. For instance, certain emotional amino acids, such phenylalanine, tryptophan, tyrosine, and adenosylmethionine, are crucial in the fight against sadness and anxiety.[18] All animals and plants need vitamin C, an important ingredient, for a variety of metabolic processes [12]. It can enhance how well iron, calcium, and folate are used, as well as encourage how tryptophan and tyrosine are metabolized. As a result, it is crucial for the production of neurotransmitters and will improve mood.

The analysis results of the logistic regression in the research shows positive relations of negative mood with intake of beverages (tea, coffee, fizzy drinks) [p = 0.0443, OR = 1.19] sweets (p = 0.0449, OR = 1.09) and fast & fried food (p = 0.0286, OR = 0.96) during the menstrual phase and with fresh fruits (bananas, grapes and dates) [p = 0.0342, OR = 1.32] and vegetables (p = 0.0429, OR = 2.25) during menstrual phase and the premenstrual phase and was considerably elevated in the depressive mood in high-score group as compared to the low-score group, which indicates that female students who were suffering from depression, tension and various other symptoms of menstrual phases try to take shelter in consumption of high calories and high antioxidant foods to relieve themselves with the help of caffeine and reduced oxidative stress.

We need to give awareness to female university students to consume a well-balanced, healthy and nutrient dense diet that include whole grains, lean protein, fresh fruits and healthy fats. This eating regiment offers important vitamins, minerals, and

antioxidants that may improve mood and general well-being during the menstrual cycle.

The limitations of the study are that its conclusions could not apply to everyone who don't live in a university environment, many females found menstruation to be a delicate subject, and were unwilling to take part. Participants had a hard time remembering and reporting their nutritional intake and emotional experiences with accuracy. Since, participants self-reported the data, which is subject to bias or inaccuracy because we haven't objectively verified it.

Conclusion

Based on the results of current study, the menstrual cycle has a negative impact on the mood of most female students, and this negative mood is linked to eating habits. Our findings imply that in postpubescent female students, nutrition and particular foods may be related to bad mood. Interestingly, the findings revealed a strong relationship between eating patterns and lifestyle factors (consuming high caloric foods like sugar, salt and fat), the severity of negative mood, while fruit and vegetable consumption were found to be protective against it. The results of the current investigation show no connection between anthropometric factors and negative mood.

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