

Are premenstrual syndrome and aggression related to body mass index in adolescents?

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Abstract. – OBJECTIVE: This cross-sectional study aimed to examine the relationship between premenstrual syndrome (PMS) and aggression during adolescence with body mass index (BMI), which is a topic not yet investigated in the literature.

PATIENTS AND METHODS: This cross-sectional study was conducted with 1,450 adolescents aged 12-18 years, who applied to the Pediatric Adolescent Outpatient Clinic and voluntarily agreed to participate in the study. Anthropometric measurements of the adolescents were taken and the Premenstrual Syndrome Scale and Buss-Perry Aggression Questionnaire were administered to the adolescents. It was discovered that all the adolescents participating in the study had PMS.

RESULTS: It was determined that as the levels of PMS were elevated, physical aggression, hostility, anger and verbal aggression gradually increased. Additionally, this increase was statistically significant ($p < 0.001$). It was further discovered that there were statistically significant differences between the BMI classifications of the adolescents and PMS, physical aggression, hostility, anger and verbal aggression statuses ($p < 0.001$). Accordingly, it was determined that as the BMI values of the adolescents increased, PMS and aggressive attitude levels increased.

CONCLUSIONS: This study is the first in the literature to examine the relationship between PMS and aggression, and BMI in adolescents. Within this framework, it was determined that PMS frequency and aggression levels were high in overweight/obese adolescents. Accordingly, it is predicted that both PMS and aggression levels can decrease with healthy body weight in adolescents.

Key Words:

Adolescent, PMS, Aggression, BMI.

Introduction

Adolescence is one of the most exciting yet difficult periods of human development. Adolescence, commonly known as the period of life between the ages of 12 and 21, is a physiological,

psychological and cognitive transformation process where a child transitions into a young adult¹.

Premenstrual Syndrome (PMS) consists of physical and/or psychological symptoms that interfere with daily activities. These symptoms are triggered by ovulation and resolve within the first few days of menstruation^{2,3}. The prevalence of women of reproductive age affected by PMS is reported⁴ to be 47.8% worldwide. It was determined that approximately 20.0% of women with PMS experienced symptoms severe enough to interfere with their daily activities, while the rest experienced mild to moderate symptoms. PMS symptoms include appetite changes, weight gain, abdominal pain, backache, low back pain, headache, breast swelling and tenderness, nausea, constipation, anxiety, irritability, anger, fatigue, restlessness, mood swings, and crying⁵. PMS in adolescents is under-recognized and possibly under-treated. Studies⁶⁻⁸ evaluating the prevalence of PMS symptoms in adolescents demonstrated that 51-86% of adolescents experienced premenstrual symptoms. Overall, 60-80% of ovulating adolescents reported at least one premenstrual symptom. In 20-30% of adolescents, these symptoms could reach more disturbing levels^{9,10}. The reason for the frequency of PMS prevalence can be associated with genetics, nutrition, lifestyle and beliefs adopted by societies before and after menstruation¹¹⁻¹³.

The concept of aggression has more than 250 definitions in the literature, and it is generally defined as anger, hatred and anger-filled, damaging behaviors^{14,15}. According to Buss and Perry¹⁶, aggression is defined as any action that harms individuals. Anger and irritability were found to be the most severe and permanent symptoms of PMS, which negatively affect women¹⁷. It is reported¹⁸ that women often complain of anger, aggression and irritability in the premenstrual period. However, the relationship between aggression and PMS has not been fully elucidated. Furthermore, there are not enough studies on this subject. It is thought⁵ that

hormonal changes in the menstrual cycle (fluctuations in estrogen and progesterone levels) affect women's moods and trigger negative emotions such as anger, aggression and irritability. Being slightly overweight/obese or aggressive during adolescence can lead to consequences that may affect the whole life. It is thought that the developmental origins of these problems can be better understood by determining the relationship between them. It is also assumed that obesity may be associated with behavioral problems in adolescence, such as aggression. Bad mood, anxiety, psychotic disorders and some physical health problems can be shown as factors that cause aggression^{19,20}.

Although the relationship between BMI and aggressive behavior problems remains unclear, there is evidence^{21,22} that aggression and oppositional behaviors are observed more frequently in obese adolescents than in adolescents with normal body weight. Although the mechanisms are not fully understood, it has been reported that there may be a relationship between obesity and mental health problems in both developing and developed countries. Most studies^{23,24} point to inflammation and oxidative stress as the cause. Although studies are limited, there is evidence²⁴⁻²⁶ that an unhealthy lifestyle triggers aggressive behaviors. It has been determined that conditions such as obesity, high sugar consumption, smoking, alcohol and insufficient physical activity are associated with aggressive behaviors. One of the biggest causes of obesity is consuming sugary products. It was shown^{27,28} that high sugar consumption can induce oxidative stress and alter the expression of certain genes associated with brain activity. The Western diet is based on a diet high in fat, sugar and salt. It has been found^{29,30} that a Western-style diet may negatively affect mental health and be associated with aggressive behaviors. Unlike glucose, high fructose in a Western-style diet does not stimulate insulin secretion and increases lipogenesis, thus negatively affecting mental health and triggering aggression³¹.

All these studies²⁷⁻³⁰ show that PMS and aggression may be related to BMI. This is the first study in the literature that aims to investigate the relationship between BMI value, PMS and aggression in adolescence.

Patients and Methods

Study Design and Data Collection

This study was conducted with 1,450 adolescents aged 12-18 years, who applied to the Pediatric

Adolescent Outpatient Clinic of the Faculty of Medicine at Dicle University, Turkey, from 16.12.2021 to 30.05.2022 and voluntarily accepted to participate in the study. This research is a cross-sectional descriptive research. The questionnaires were administered by the researcher to face-to-face interview method. The individuals with chronic diseases, who refused to participate in the study, who did not menstruate, and who were later determined not to be between the ages of 12-18 were excluded from the study. Informed consent was obtained from all individual participants included in the study. For the study, the Ethics Committee approval was received from the Non-Invasive Clinical Research Ethics Committee of the Faculty of Medicine at Dicle University, Turkey, on 15.12.2021 with issue number 54.

Anthropometric Measurements

Anthropometric measurements of the participants were taken by the researcher. Body weight and height measurements were conducted with the 12-18 years adolescents and body mass index values [BMI: body weight (kg) / height (m²)] were calculated. In the study, the height and body mass index values for age were evaluated using the "WHO AnthroPlusSoftware" (Geneva, Switzerland) and "WHO reference values for children aged 5-19 years-2007". The reference includes BMI (5-19 years) z-score values by age³².

Premenstrual Syndrome Scale

The Premenstrual Syndrome Scale (PMSS) is a scale developed by Gençdoğan³³. The scale is a five-point Likert-type scale consisting of 44 items. The PMSS score consists of the total score of the subscales. The minimum score to be obtained from the scale is 44, while the maximum score is 220. High scores obtained from the scale indicate that PMS symptoms are experienced more frequently.

Buss-Perry Aggression Scale

Buss-Perry Aggression Scale is a scale developed by Buss and Perry¹⁶ in 1992 to measure aggression. The Turkish adaptation, validity and reliability studies of the scale were conducted by Can³⁴ in 2002. The validity and reliability investigations of the scale on non-adults were performed by Demirtaş-Madran¹⁵ in 2012 and the scale was simplified by reducing the 34 items of the scale to 29 items. This scale, adapted by Demirtaş-Madran¹⁵, is also a 5-point Likert-type scale. It aims to evaluate four different subscales of aggression, namely, physical aggression, verbal aggression, hostility and anger.

Statistical Analysis

The Statistical Package for the Social Sciences 21 (SPSS-21 IBM Corp., Armonk, NY, USA) package software was used to evaluate the data. Pearson's Chi-Square test was used in the comparison of qualitative data and the investigation of the differences between groups when the number of observations in the data less than 5 in the charts did not exceed 20% of the total number of observations. Kolmogorov-Smirnov and Shapiro-Wilk tests were conducted to determine whether the quantitative data were normally distributed. One-way analysis of Variance (ANOVA) was used to evaluate the means between three normally distributed groups, while mean (\bar{x}), standard deviation (SD), and minimum and maximum values were presented. Post-hoc tests were used to determine the differences between the groups in the data that had significant differences in the ANOVA test, and the Tukey test was used when the variances were homogeneous ($p > 0.05$). Additionally, Tamhane's T2 test was used when the variances were not homogeneous. The Pearson's Correlation test was used to reveal the strength and direction of the linear relationships between two normally distributed continuous variables. In the study, the confidence interval was regarded as 95% in all statistical tests. The statistical significance level was set at $p < 0.05$.

Results

The general information on the adolescents participating in the study is presented in Table I. It was determined that the mean age of the adolescents was 15.8 ± 2.0 years. Of the participants,

6.0% were underweight, 51.8% were normal weight, and 42.2% were slightly overweight/obese. Furthermore, it was determined that 7.9% of the participants were smokers.

Body Mass Index (BMI)

The PMS classification of adolescents is presented in Table II. The presence of PMS was discovered in all adolescents. Accordingly, it was determined that 67.7% of the adolescents had moderate PMS while 19.7% had mild PMS in addition to the 12.6% with severe PMS, while the mean PMS score was 129.4 ± 33.0 .

The mean scores in the subscales of the Aggression Questionnaire of the adolescents participating in the study are presented in Table III. The mean score of the physical aggression subscale was 26.8 ± 5.2 , while the mean score of the hostility subscale was 23.0 ± 6.0 . Furthermore, the mean score of the anger subscale was 19.9 ± 4.7 , while the mean score of the verbal aggression subscale was 14.8 ± 4.3 .

Aggression statuses of the adolescents based on PMS are presented in Table IV. It was determined that as the level of PMS increased, physical aggression, hostility, anger and verbal aggression levels gradually increased, which was statistically significant ($p < 0.001$).

The total scores in PMS and Aggression Questionnaires of adolescents based on BMI classification are presented in Table V. Accordingly, it was determined that there was a statistically significant difference between PMS, physical aggression, hostility, anger and verbal aggression and BMI classification of adolescents ($p < 0.001$). In the analyses, all the scores were found to be higher in slightly overweight/obese adolescents compared to other groups ($p < 0.001$).

Table I. Descriptive statistics of the adolescents.

Age and Anthropometric Measurement (Mean \pm Standard Deviation)	Age (years)	15.8 \pm 2.0
	Height (cm)	161.6 \pm 7.3
	Weight (kg)	55.7 \pm 10.4
	BMI (kg/m ²)	21.2 \pm 3.5
BMI category, N (%)	Underweight	87 (6.0)
	Normal	751 (51.8)
	Overweight/Obese	612 (42.2)
Income level, N (%)	Low	308 (21.2)
	Moderate	524 (36.2)
	High	618 (42.6)
Educational Status, N (%)	Student	1,403 (96.8)
	Nonstudent	47 (3.2)
Smoking Status, N (%)	Smoker	114 (7.9)
	Nonsmoker	1,336 (92.1)

Discussion

Adolescence is considered a critical period of human development due to physical, emotional and cognitive changes, and because there are many stress factors today. Moreover, aggressive attitudes/aggression/anger continue to be a common experience for many people, especially adolescents³⁵. In the literature, aggression is associated with PMS. Many behavioral and psychological changes

in PMS can cause various problems in human mental health depending on their severity and individual tolerance. Within this framework, it is assumed that obesity may also be associated with adolescent behavioral problems, such as aggression. Mental health problems, such as mood, anxiety and psychotic disorders and physical health problems can lead to the emergence of aggression^{19,20}.

The current study aims to reveal the prevalence of PMS, a common syndrome affecting adolescents during their reproductive years, and the relationship between PMS and aggression, and evaluate the relationship between BMI, PMS and aggression. There is a limited number of studies on PMS and aggression in adolescence, while there is no study examining the relationship of both these concepts with BMI. Accordingly, this study is the first on the subject and presents a valuable contribution to the literature.

Since adolescence is an emotionally complex period, the prevalence of PMS is expected to be high in adolescents. In this study, it was determined that all the adolescents had PMS. Similar to our study, in a study³⁶ conducted in Egypt, the presence of PMS was determined in all adolescent females, and it was reported that 66.4% of the adolescents had moderate PMS, while 21.4% had severe, in addition to the 12.2% who had mild PMS. In a study conducted by Kamat et al³⁷ with 1,702 adolescents, the presence of severe PMS was determined in 19.3% of the adolescents. In a study conducted by Bahrami et al³⁸ with

Table II. Total PMS scores and PMS classifications of the adolescents.

PMS	N	Percentage (%)
Mean PMS Score ($\bar{x}\pm SD$)		129.4±33.0
PMS Classification		
Mild	285	19.7
Moderate	981	67.7
Severe	184	12.6

Premenstrual Syndrome (PMS).

Table III. Mean scores, minimum and maximum values of the adolescents in the Aggression Scale.

Subscales of Aggression Questionnaire	$\bar{x}\pm SD$	Min-max
Physical Aggression	26.8±5.2	10.0-41.0
Hostility	23.0±6.0	8.0-40.0
Anger	19.9±4.7	9.0-44.0
Verbal Aggression	14.8±4.3	5.0-25.0

Table IV. Evaluation of the adolescents based on PMS and aggression statuses.

Aggression	PMS			p^*
	Mild Level	Moderate Level	Severe Level	
Physical Aggression	24.4±5.1	27.2±4.8	28.2±6.3	<0.001
Hostility	19.9±5.1	23.5±5.6	25.2±7.5	<0.001
Anger	17.5±3.9	20.3±4.5	21.9±5.3	<0.001
Verbal Aggression	12.5±4.6	15.0±3.8	17.2±4.8	<0.001

*ANOVA test, Premenstrual Syndrome (PMS).

Table V. Total scores of PMS and Aggression Questionnaire based on the BMI classification of the adolescents.

PMS and Aggression Total Scores	Underweight	Normal Weight	Slightly Overweight/Obese	p^*
PMS	122.5±38.0	124.7±28.8	136.1±35.8	<0.001
Physical Aggression	26.3±4.5	26.0±4.6	27.8±5.8	<0.001
Hostility	22.2±4.9	22.5±5.2	23.8±6.9	<0.001
Anger	19.6±4.0	19.4±4.2	20.7±5.2	<0.001
Verbal Aggression	15.2±4.1	14.2±3.9	15.5±4.7	<0.001

*ANOVA test, Premenstrual Syndrome (PMS).

897 adolescents in Iran, 14.9% of adolescents were reported to have severe PMS.

Aggression in adolescents is a complex phenomenon that includes multiple elements and manifests itself in various forms. Variables associated with this phenomenon include personal characteristics and socio-emotional and cognitive variables³⁹. The fact that changing hormone levels in adolescence may cause anger and confusion and, in some cases, the acceptance of changes in their bodies may cause stress have been identified as the reasons for a high frequency of aggression in adolescence⁴⁰. In a systematic review⁴¹ examining aggression in Iranian adolescents, the prevalence of aggression was reported to be between 40.0% and 89.0%. In a recent study⁴² examining the aggression of adolescents in Turkey, the mean scores in the physical aggression, hostility, anger and verbal aggression subscales of the Buss Perry Aggression Questionnaire were 17.7 ± 6.5 , 19.1 ± 6.6 , 15.5 ± 5.5 and 11.7 ± 3.7 , respectively. In the current study, the mean scores in the subscales of the Aggression Questionnaire of adolescents were higher. Additionally, the mean score of the physical aggression subscale was 26.8 ± 5.2 , while the mean value of the hostility subscale was 23.0 ± 6.0 . The mean value of the anger subscale was 19.9 ± 4.7 , while the mean value of the verbal aggression subscale was 14.8 ± 4.3 .

It is reported^{17,43} that adolescents are sensitive to anger and aggression before menstruation. However, the relationship between aggression, BMI, and PMS has not been clarified yet. Sarkar et al⁴⁴ reported that 61.5% of adolescent females had PMS, and 70.5% had aggressive behaviors. In another study⁴⁵, 45.7% of adolescent females diagnosed with PMS had aggressive behaviors. In the study of Uzunoğlu and Aktan⁴⁶, in which they examined the relationship between PMS and aggression in adolescents, it was determined that as the level of PMS increased, the level of aggression also increased. In this study, it was found that as the level of PMS increased, physical aggression, hostility, anger and verbal aggression gradually increased, which was statistically significant ($p<0.001$).

Being overweight/obese or aggressive during adolescence may lead to consequences that may affect the whole life. Accordingly, it is thought that the developmental origins of these problems can be better understood by determining the relationship between them. Large-scale studies in Australia⁴⁷ and the United States⁴⁸ demonstrated that the proportion of adolescents (12 to 18 years old) engaging in aggressive behavior ranged

from 18% to 33%. In the study of Banis et al⁴⁹, it was determined that obese females had higher aggression and ruthlessness levels compared to normal-weight females ($p<0.001$). In the study by Eschenback et al⁵⁰, it was determined that the incidence of behavioral disorders was higher in obese children and adolescents compared to non-obese children ($p<0.001$). According to the results of Halfon et al⁵¹'s study with a large sample in America, internalization and externalizing problems, low school achievement, attention deficiency, behavioral disorders and depression were higher in obese children and adolescents compared to non-obese children. In the study conducted by Hwang et al⁵² in Korea, it was determined that overweight children and adolescents demonstrated more aggressive behaviors compared to children and adolescents without weight problems ($p=0.025$). In the study conducted by Seyedamin et al⁵³ in Iran, behavioral problems were reported in 17%, 27% and 2% of obese, slightly obese and normal-weight children, respectively ($p<0.001$). Similar to the literature, in the current study, a statistically significant difference was discovered between physical aggression, hostility, anger and verbal aggression and the BMI classification of adolescents ($p<0.001$).

Not adopting a healthy lifestyle, lack of physical activity, malnutrition and obesity cause many health problems. There is evidence that one of these problems is PMS. In the study by Rad et al⁵⁴ on female high school students, it was determined that there was a positive and significant relationship between PMS and obesity. In the study by Ashfaq and Jabeen⁵⁵, it was determined that 78.7% of adolescent females had PMS, and the incidence of PMS in slightly obese adolescents (94.1%) was higher than in normal-weight (64.0%) adolescents. In the current study, a positive correlation was discovered between the BMI values of adolescents and PMS ($p<0.001$).

Limitations and Strengths of the Study

The limitations of the study are that the sample was taken from a single center and a single city. The strength of the study is that it is the first study in the literature examining the relationship between PMS, aggression and BMI value in adolescence.

Conclusions

Adolescent obesity is associated with many health problems and may cause chronic diseases that may occur in the future. Understanding the

relationship between aggression in adolescence and the presence of PMS and BMI is important in terms of determining appropriate management strategies. Accordingly, it is thought that clinical improvement can be achieved in aggression and PMS with the acquisition of healthy eating habits, preservation of ideal body weight, and necessary training and psychological support in this regard.

Authors' Contributions

Derya Çağiran contributed to the conception and design of the research, the collection and analysis of the data and created the original draft and reviewed and edited subsequent versions. All authors contributed to the design of the research, to the analysis and interpretation of the data and to writing, reviewing, and editing. All authors agree with the final manuscript being submitted. All authors declare that the content of the manuscript has not been published elsewhere.

Conflict of Interest

The authors declare no conflict of interest.

Data Availability

The datasets used and analyzed in the current study are available from the corresponding author upon reasonable request.

Ethics Approval

All the procedures that involved human subjects were approved by the Ethics Committee of Dicle University (25.01.2022 with issue number 12).

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