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The impact of climate change anxiety on premenstrual syndrome: A cross-sectional study

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Abstract

Objective: Climate change is thought to have possible effects on changes in the menstruation process, which covers an important period of time in women's lives. Our study aimed to determine the impact of climate change anxiety on premenstrual syndrome (PMS) in women of reproductive age.

Methods: This is a cross-sectional study. The research was conducted online using various digital platforms between December 2023 and February 2024. This study was conducted on 456 women of reproductive age. The Personal Information Form, PMS Scale and Eco-Anxiety Scale were used for the data collection. The level of statistical significance was set at $p < 0.05$.

Results: The prevalence of PMS was 44.7%. The average score for the Eco-Anxiety Scale was 27.28 ± 6.44. A significant majority of participants (81.4%) stated that climate change would affect women's health, and 81.1% thought that they were affected by climate change. The Eco-Anxiety Scale scores were higher in women with PMS ($p < 0.05$). The results of the binary logistic regression analysis showed that being affected by climate change (odds ratio [OR] = 2.109, 95% confidence interval [CI] = 1.045–4.259, $p = 0.035$), age at menarche (OR = 1.249, 95% CI = 1.073–1.453, $p = 0.004$) and Eco-Anxiety Scale scores were significant predictors of PMS (OR = 0.828, 95% CI = 0.791–0.867, $p < 0.001$).

Conclusion: The results of our study showed that women with PMS had higher Eco-Anxiety Scale scores. Given the global effects of climate change, it is important to investigate its effects as a risk factor for the emergence of PMS. Furthermore, women's healthcare providers play an important and beneficial role in adapting to a changing climate; these efforts will have long-term impacts.

KEYWORDS

climate changes, eco-anxiety, premenstrual syndrome, women health

1 | INTRODUCTION

Climate change is defined as the change in climate and the deterioration in the composition of the atmosphere as a result of direct or indirect human activities, in addition to the natural change observed over a comparable period of time.[1,2] While the debate centres on natural phenomena such as rising temperatures, extreme weather events and ecosystem disruptions, climate change has many detrimental impacts on human health.[3] A less researched area is the link between climate change and menstrual health. Changing climate patterns contribute to temperature fluctuations, affecting the delicate hormonal balance in women. Research shows that rising temperatures can lead to changes in the menstrual cycle and cause irregularities, such as changes in cycle length, increased menstrual quantity, skipped cycles or increased premenstrual symptoms.[4] Furthermore, stress and anxiety associated with climate change affect menstrual health both directly and indirectly. Uncertainty about the future, loss of homes or livelihoods due to extreme weather events, and general environmental degradation can also contribute to mental health problems and affect menstrual cycle regularity.[5]

One of the emerging impacts of climate change is ecological anxiety, which refers to the mental distress, fear or worry associated with changing and deteriorating environmental conditions. The concept of ecological anxiety refers to distress, stress and anxiety related to the climate change crisis.[6,7] Therefore, the terms ecological anxiety and climate change anxiety are often used interchangeably.[8] Climate change has measurable negative impacts on women's general health, mental health and reproductive health. Women are more vulnerable to the impacts of climate change at different stages of life due to a combination of biological, physiological, socioeconomic and cultural risk factors.[3,6] A survey of more than 1300 respondents in Sweden found that women are more concerned about climate change and its impacts on future generations.[9] The literature states that climate change causes many complications related to reproductive health, pregnancy and childbirth and that the situation will worsen with the impact of climate change.[1,10] Due to women's negative experiences with climate change and climate change-related events, women's health, both physical and psychological, is affected in different ways.[11] Although women do not experience ecological concerns, they have a variety of environmental concerns that can affect their sexual health and reproductive lives throughout their lives.[6]

Premenstrual syndrome (PMS), which is a reproductive health problem, affects an important period of time in women's lives. Although the pathophysiology of PMS is not fully understood, it has been shown in the literature that the onset and course of PMS is related to stress.[12] The cause of PMS is not known exactly in the literature. However, many factors, such as hormonal levels, genetic characteristics, environmental conditions, stress, trauma, seasonal changes and climatic characteristics, are related to PMS.[13,14] As a vulnerable group, women are more concerned about and affected by climate change. Therefore, climate change is thought to have possible effects on changes in the menstrual process, which covers an important period in women's lives. However, to the best of our knowledge, no study has shown the effect of climate change anxiety on PMS and related symptoms. In this context, our study aimed to determine the impact of climate change anxiety on PMS in reproductive-aged women.

2 | METHODS

2.1 | Study design and participants

This cross-sectional study was conducted between December 2023 and February 2024. The CHERRIES criteria were followed to conduct the online survey.[15] In which the sampling formula with an unknown universe was calculated as a minimum of 384 individuals. In the literature, it is stated that the sample size can be increased by at least 10% to reach the final sample size considering data losses.[16] Therefore, it was planned to include at least 422 women in the sample group against the possibility of participants dropping out of the study during the implementation period. The study sample consisted of 456 women who completed the questionnaire on relevant dates.

2.1.1 | Inclusion and exclusion criteria

The study population consisted of women of reproductive age who were over 18 years. The inclusion criteria were being over 18 years of age, able to read and understand Turkish, not having reached menopause, and agreeing to participate in the study. Adolescents under 18 years of age and menopausal women were excluded from the study.

2.1.2 | Study variables

The dependent variables were the scores obtained from the Eco-Anxiety Scale and the scores obtained from the PMS Scale. The independent variables were age, age at menarche, menstrual cycle characteristics, educational status, working status, income level, having children and opinions about climate change.

2.2 | Data collection

The survey form, prepared using Google Forms, was sent to the participants. This ensured that many women living in the different regions of Türkiye were represented. Data were collected through a web-based online questionnaire created using Google Forms. The form was shared in social media groups (WhatsApp, Instagram, etc.) where the participants who met the inclusion criteria participated intensively. The page administrators who created the relevant groups on these platforms were contacted and the questionnaire was shared in the groups at certain intervals. Before the web-based survey, the participants were asked to approve the consent form, indicating that they agreed to participate in the study. The participants took an average of 10–15 min for the participants to answer the questionnaire. Participants could not send the form with incomplete answers because of

compulsory questions. Therefore, there was no loss of data owing to incomplete responses to the questionnaires.

2.3 | Data collection tools

The 'Personal Information Form', 'Premenstrual Syndrome Scale (PMSS)' and 'Eco-Anxiety Scale' were used to collect the data.

2.3.1 | Personal information form

There were a total of 28 questions about sociodemographic (age, education level, working status, etc.) and menstruation (menarche age, physical and psychological changes before menstruation, etc.) characteristics of women, and questions about the effects of climate change (information about climate change, climate change has negative consequences for women's health, etc.) in the form composed of the researchers by reviewing literature.[17–19]

2.3.2 | PMSS

This scale was developed by Gençdoğan (2006) to assess women's PMS and premenstrual symptoms. The scale has nine subscales (depressive affect, irritability, anxiety, appetite changes, pain, fatigue, depressive thoughts, bloating and sleep changes). It is a 44-item, five-point Likert-type scale. The scale consisted of nine dimensions. If women scored over 132 points, they were considered to have PMS. In addition, an increase in women's scores on the scale indicated an increase in the severity of PMS. The Cronbach's alpha reliability coefficient of the scale was 0.75.[20] The Cronbach's alpha reliability coefficient of the scale for this study was 0.90.

2.3.3 | Eco-Anxiety Scale

The Scale, developed by Hogg et al. in 2021 and adapted into Turkish by Türkaslan et al. (2023), assesses the psychological reactions of individuals when they encounter environmental problems.[21] The scale consists of four subdimensions and 13 items. The subdimensions of the scale were anxiety symptoms, rumination, behavioural symptoms and personal effects. The increase in the total score of the Eco-Anxiety Scale and the average score of the subdimensions indicated an increase in the level of ecological anxiety. Cronbach's alpha coefficients of the Eco-Anxiety Scale and its subdimensions vary between 0.88 and 0.0.92.[21] The Cronbach's alpha reliability coefficient of the scale in this study was 0.78.

2.4 | Statistical analysis

Descriptive characteristics of the participants related to sociodemographic factors, menstruation and climate change were given as percentages. Chi-square analysis was used to compare categorical variables to determine the relationship between PMS and other variables. The data were examined for normality using the Kolmogorov–Smirnov test. The Mann–Whitney U test was used to compare continuous variables due to their nonparametric distribution. Finally, binary logistic regression was used to test the variables that were thought to affect PMS in previous analyses and were found to be statistically significant (marital status, having children, age at first menarche, eco-anxiety scale scores, thinking that climate change has an effect on women's health, and being affected by climate change). Model fit was evaluated using the Hosmer–Lemeshow test. In this study, the Hosmer–Lemeshow test $p = 0.744$. If the p value in the model is greater than 0.05, it is accepted that the predictive value of the model is high. The level of statistical significance was set at $p < 0.05$.

2.5 | Ethical statement

Ethical approval was obtained from the Non-Interventional Ethics Committee of Bilecik Seyh Edebali University (Date: 05.12.2023, Number: 8). Participants also marked their consent to participate on the informed consent page before they started filling out the questionnaire.

3 | RESULTS

The mean age of the participants was 26.94 ± 7.0). Most had a bachelor's degree (75.0%) and were single (66.2%). Almost all the participants reported experiencing physical (95.8%) and psychological (95.6%) changes before menstruation (Table 1).

Table 2 shows the participants' climate change and menstrual cycle characteristics. More than half of the participants (59.2%) stated that their knowledge of climate change was adequate. Of the participants, 81.4% stated that climate change would affect women's health, and 81.1% stated that they thought they were affected by climate change (Table 2).

When the relationship between the presence of PMS and the Eco-Anxiety Scale scores were analysed, the Eco-Anxiety Scale scores were higher in women with PMS ($p < 0.001$) (Table 3).

Of the study participants, 204 (44.7%) had PMS. The average score for the Eco-Anxiety Scale was 27.28 ± 6.44, which is at a medium level. The relationship between the PMS and some variables is presented in Table 4. The presence of PMS was higher in singles ($p = 0.007$), those who had children ($p = 0.035$), those who thought that climate change had an effect on women's health ($p = 0.029$), those who stated that they were negatively affected by climate change ($p = 0.001$) and those with a younger age at menarche ($p = 0.001$) (Table 4).

The results of the binary logistic regression analysis showed that being affected by climate change (odds ratio [OR] = 2.109, 95% confidence interval [CI] = 1.045–4.259, $p = 0.035$), age at menarche (OR = 1.249, 95% CI = 1.073–1.453, $p = 0.004$) and Eco-Anxiety Scale scores were significant predictors of PMS (OR = 0.828, 95% CI = 0.791–0.867, $p < 0.001$). The three predictors in this model can explain 34% of the variance in PMS (Table 5).

TABLE 1 Sociodemographic and menstrual characteristics of study participants.

Characteristics	*n* (%)/mean (SD)
Age, mean (SD)	26.94 (7.0)
Education level, *n* (%)	
Primary/secondary school	13 (2.9)
High school	61 (13.4)
University	342 (75.0)
Postgraduate	40 (8.8)
Working status, *n* (%)	
Yes	243 (53.3)
No	213 (46.7)
Income status, *n* (%)	
Low	54 (11.8)
Middle	236 (51.8)
High	166 (36.4)
Marital status, *n* (%)	
Single	302 (66.2)
Married	142 (31.1)
Divorced	12 (2.6)
Number of children, *n* (%)	
Yes	94 (20.6)
No	362 (79.4)
Menarche age, mean (SD)	13.08 (1.5)
Menstruation duration, mean (SD)	5.78 (1.48)
Menstruation frequency, mean (SD)	28.78 (11.03)
Physical changes before menstruation, *n* (%)	
Yes	437 (95.8)
No	19 (4.2)
Psychological changes before menstruation, *n* (%)	
Yes	436 (95.4)
No	20 (4.4)

TABLE 2 Climate change and menstrual cycle characteristics of study participants.

Characteristics	*n* (%)
Information about climate change	
Sufficient	270 (59.2)
Insufficient	162 (35.5)
I don't know	24 (5.3)
Changes in menstrual patterns	
Yes	227 (49.8)
No	229 (50.2)
Consequences of climate change	
Positive	10 (2.2)
Negative	412 (90.4)
I don't know	34 (7.5)
Negative impact of climate change on women's health	
Yes	371 (81.4)
I don't know	85 (18.6)
Affected by climate change (in terms of women's health)	
Yes, I am negatively affected	370 (81.1)
No, I don't think I'm affected	66 (14.5)
Yes, I am positively affected	20 (4.4)
Physical changes due to climate change before menstruation	
Yes	100 (21.9)
No	111 (24.3)
I'm undecided	228 (50.0)
Psychological changes due to climate change before menstruation	
Yes	126 (27.6)
No	109 (23.9)
I'm undecided	201 (44.1)

TABLE 3 Relationship between the presence of PMS and Eco-Anxiety Scale.

	With PMS (*n* = 204)		Without PMS (*n* = 252)		Statistical analysis
	Mean	SD	Mean	SD	U = 11699.5; $p < 0.001$
Eco-Anxiety Scale (27.28 ± 6.44)	30.59	6.34	24.61	5.15	

Note: Bold values indicate statistically significant at $p < 0.05$.
Abbreviation: PMS, premenstrual syndrome.

4 | DISCUSSION

The literature indicates that globally, 52% of the world's female population is of reproductive age and continues to experience menstruation as a normal part of their lives.[22] Stress resulting from individual and environmental factors causes women to become vulnerable to changes in cycle length and/or negative changes in symptoms. Climate change, an environmental factor, affects women in many areas. Global warming and subsequent climate change have significantly increased stress levels worldwide.[23,24] While studies investigating environmental events have reported that stress worsens PMS symptoms,[25] to our knowledge, our study is the first to show the impact of anxiety about climate change on PMS and related symptoms. No study has examined the effects of climate change and climate change anxiety on PMS. Therefore, our study results are discussed in line with the relevant literature without comparing different studies. The results of our study

TABLE 4 PMS and its association with some variables.

Characteristics	With PMS (n = 204) n (%)	Without PMS (n = 252) n (%)	Statistical analysis p Value[a]
Education status			
Primary/secondary school	2 (1.0)	11 (4.4)	0.151
High school	25 (12.3)	36 (14.3)	
University	158 (77.4)	184 (73.0)	
Postgraduate	19 (9.3)	21 (8.3)	
Working status			
Yes	115 (56.4)	128 (50.8)	0.235
No	89 (43.6)	124 (49.2)	
Income status			
Low	84 (41.2)	82 (32.5)	0.150
Middle	99 (48.5)	137 (54.4)	
High	21 (10.3)	33 (13.1)	
Marital status			
Single	150 (73.5)	152 (60.3)	**0.007**
Married	48 (23.5)	94 (37.3)	
Divorced	6 (2.9)	6 (2.4)	
Does have any children			
Yes	33 (16.2)	61 (24.2)	**0.035**
No	171 (83.8)	191 (75.8)	
Information about climate change			
Sufficient	116 (56.9)	154 (61.1)	0.549
Insufficient	78 (38.2)	84 (33.3)	
I don't know	10 (4.9)	14 (5.6)	
Negative impact of climate change on women's health			
Yes	175 (85.8)	196 (77.8)	**0.029**
I don't know	29 (14.2)	56 (22.2)	
Affected by climate change (in terms of women's health)			
Yes, I am negatively affected.	181 (88.8)	189 (75.0)	**0.001**
No, I don't think I'm affected	16 (7.8)	50 (19.8)	
Yes, I am positively affected.	7 (3.4)	13 (5.2)	

	Mean	SD	Mean	SD	p Value[b]
Age	25.85	5.87	27.81	7.69	0.055
Menarche age	12.79	1.66	13.32	1.33	**0.001**
Menstruation duration	5.81	1.53	5.75	1.44	0.383
Menstruation frequency	29.85	15.04	27.95	5.99	0.418

Note: Bold values indicate statistically significant at $p < 0.05$.

Abbreviation: PMS, premenstrual syndrome.

[a]Chi-square.

[b]Mann–Whitney U test.

TABLE 5 Binary logistic regression analysis showing factors associated with PMS.

Variables (Ref = Yes)	*B*	Sig	*OR*	95% CI for *OR* Lower–upper
Marital status (ref = single)				
Married	0.588	0.096	1.800	0.901–3.593
Divorced	0.291	0.697	1.337	0.310–5.776
Status of having children (ref = yes)				
No	−0.262	0.524	0.770	0.344–1.721
Affected by climate change (ref = yes, I am negatively affected)				
No, I don't think I'm affected	0.746	**0.037**	2.109	1.045–4.259
Yes, I am positively affected	0.383	0.454		
Negative impact of climate change on women's health (ref = yes)				
I don't know	0.069	0.818	1.071	0.509–1.925
Menarche age	0.222	**0.004**	1.249	1.073–1.453
Eco-Anxiety Scale	−0.188	**0.000**	0.828	0.791–0.867
Model summary				
Cox and Snell R square	0.257			
Nagelkerke R square	0.344			
Hosmer and Lemeshow Test	0.744			

Note: The reference PMS status category was 'with PMS'.

Abbreviations: CI, confidence interval; OR, odds ratio; PMS, premenstrual syndrome; Ref, reference group.

showed that women with PMS have higher Eco-Anxiety Scores. Furthermore, among the various factors found to be associated with PMS, PMS showed a significantly larger association effect among those who felt affected by climate change and those with higher climate change anxiety scores. Climate change is perceived as the greatest potential threat to public health in the twenty-first century.[10,11,26] In studies in the literature, it is reported that women are more concerned about climate change and worried about their future than men.[19,27–29] The seriousness of the concerns that society, particularly women, are experiencing due to climate change makes it necessary to examine its impact on women's health.

Due to women's concern about climate change and the negative experiences they have had, its negative impacts on mental health are noteworthy area.[11] In addition to the effects of climate concerns on psychological health, their impact on women's sexual and reproductive health is also significant.[19] Various climate-related events, such as extreme heat and increased average seasonal temperatures, poor air quality, natural disasters and so on, have a negative impact on sexual and reproductive health outcomes.[3,30] In the literature, it is stated that women are more susceptible to the development of climate-related anxiety, worry and stress than men, although it is seen as a factor that can affect society, regardless of gender.[19,31] The problems experienced in this process can be expected to increase the incidence of PMS by affecting women's hormonal cycles, and the findings of our study support this idea. PMS is a reproductive health problem, and 90% of women experience at least one PMS symptom.[32] This condition represents a major public health problem globally. Various factors are thought to be responsible for the emergence of PMS, and the debate on this issue is still ongoing. In particular, changes in women's lives and stressful life events may exacerbate PMS by affecting the hypothalamic–pituitary–adrenal axis.[12,32] Women have stronger reactions to emotional changes before menstruation or during the luteal phase, suggesting that negative emotions or mood swings potentiate PMS symptoms. Considering that the effects of climate change will increase and its negative effects on women's health, it is extremely important to implement interventions by conducting studies on the subject.

Information on climate change, its negative impacts and dire consequences can contribute to increased public concern about climate change. Education also plays an important role in reducing the risks of ecological anxiety. Studies have shown that information about climate change reduces climate change anxiety.[7,33] Given this situation, it can be assumed that people who are more educated on this issue are more likely to exhibit proenvironmental behaviours, and thus reduce their climate change concerns and risks.[7,31,33] In our study, more than half of the participants thought that they had sufficient knowledge about climate change, and the high awareness of the participants on this issue is an important finding for our study. However, in this study, no significant relationship was found between PMS and knowledge of climate change. This may be explained by the fact that knowledge about climate change is based on self-reports. However, further studies on this subject are required. In addition, it is known that education and training interventions on climate change can increase the level of knowledge about climate change and help reduce anxiety.[33] Therefore, it is thought that providing information on climate change and its effects on women's health will play an important role in combating climate change. Our study results show that climate change anxiety may be a significant risk factor for PMS. Therefore, it is important to conduct further research to examine the effects of climate change and related factors on PMS.

5 | LIMITATIONS

One of the limitations of this study is that the diagnosis of PMS was based on retrospective symptom reporting, which has limited validity. Therefore, the reported frequency and intensity of symptoms may overestimate or underestimate actual effects. Another limitation is that the study was conducted over a specific time period and in a specific sample; therefore, it cannot be generalised to all women. No explanation was given to the participants about climate change, and they answered the questionnaire in line with their own knowledge and experiences. The difference in the participants' level of knowledge of the subject may have affected the meaning of the scale items and had an impact on the participants' responses.

6 | CONCLUSION

The results of our study revealed that women with PMS have higher Eco-Anxiety Scores. Additionally, among the various factors associated with PMS, it was found to have a significantly stronger association with those who felt impacted by climate change and those with higher levels of climate change anxiety. Women's healthcare providers play a crucial and beneficial role in adapting to a changing climate, and their efforts will have long-term impacts. Women's health nurses and midwives can educate women about the health risks associated with climate change and advocate for policies that support climate change mitigation. We recommend climate policy interventions for sexual and reproductive health as the key to improving the lives of women worldwide. Additionally, more research is needed on the impacts of climate change on reproductive health, such as PMS, to address gaps in the literature and better understand the global effects of climate change.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analysed in this study.

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