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The effect of regular aerobic exercises on premenstrual syndrome in sedentary women

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Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

abstract

Background: Premenstrual symptoms (PMS) occur very commonly and cause a negative impact on the overall quality of women's lives. The aim of this study was to assess the PMS symptoms between women who exercise and non-exercising sedentary women.

Material and methods: A total of 220 participants were studied. N = 100 exercising group and N = 120 non-exercising were selected as participants. The exercising group was selected from women who regularly do aerobic exercise (walk-running) for 3−5 days a week, within a 60 minute time period for each exercise session for 4 months.

Results: The mean number of menstruations in a year and the frequency of menstruations were compared between the exercising group and the non-exercising group. No significant differences were found in that respect, but significant differences were found for the length of the menstrual flow. Premenstrual PMS scores were found significantly higher in the non-exercising group than the exercising group. Water retention, negative affect, impaired concentration, behavioral change, arousal and control scales show significantly higher scores in the non-exercising group than in the exercising group in the premenstrual phase.

Conclusions: The obtained results allow concluding that in women who exercise regularly, some PMS symptoms occur less frequently and are less intense than in sedentary women; therefore, physical activity may be recommended as a method of reducing menstrual symptom severity.

Key words: sedentary women, premenstrual syndrome, aerobic exercise.

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INTRODUCTION

Numerous studies have indicated that menstrual pain, premenstrual symptoms (PMS) and irregular menstrual cycles occur often and cause a negative impact on the overall quality of women's lives. Especially, PMS is among the most common health problems reported by reproductive-age women [1, 2, 3]. PMS is the name given to a collection of physical, emotional and behavioral symptoms that some women experience during the late luteal phase of each menstrual cycle (7 to 14 days prior to menstruation) [2, 4, 5]. Anxiety, depression, dysphoria, persistent irritability, affective lability, paranoid perception and hyperprosexia are the most frequent among emotional and behavioral symptoms [6, 7, 8]. Physical symptoms and signs may include fatigue, headache, abdominal bloating, weight gain, breast tenderness [9], exhaustion, decreased interest in everyday activities and lack of concentration [8, 10, 11].

In the world scientific literature, there is abundant evidence related to PMS and different pharmacologic and non-pharmacological methods for reducing the risk of PMS. Modification of dietary habits, stress management, weight control, gaining and maintaining an exercise habit have positive influences on this problem [5]. Exercising has been proposed as a potential treatment in this regard, and several observational studies have reported a reduction in the risk of PMS and the associated symptomatology in physically active women compared to their less active counterparts [12, 13]. Results of these studies have shown inconsistent data concerning the effect of physical activity on PMS, since some of the studies have defended the positive effects of exercising on PMS [14, 15], whereas others have shown no association [5, 16, 17] and even revealed an increased risk of PMS among the exercising women [18].

This study aims to assess and compare the PMS symptoms observed in exercising and non-exercising sedentary women.

MATERIAL AND METHODS

Participants

A total of 220 healthy sedentary women participated voluntarily in this study. All participants underwent health exams to ensure that they were not taking any medications (including anti-pregnancy ones) and nor smoked cigarettes, and women who were pregnant, menopausal or amenorrheal for other reasons were excluded. Participants were divided into two groups, the exercising group (n = 100; age 23.07 ±4.76 years; menarche age 13.72 ±1.23; height 162.3 ±6.4 cm; weight 55.92 ±7.54 kg) and the non-exercising group (n = 120; age 23.05 ±4.77 years; menarche age 13.8 ±1.2 age; height 162.14 ±6.27 cm; weight 56.12 ±7.21 kg). The exercising group was selected from women who regularly perform aerobic exercise (walk-running) for 3−5 days a week for 4 months. Non exercising group did not attend regularly sports activities (more than one hour per week).

Menstrual history

A Demographic Data Questionnaire and Menstrual Distress Questionnaire (MDQ) [19] were used to collect data. MDQ questionnaire was adapted for the Turkish society in 1992, and reliability coefficients were found 0.71−0.91 [20].

Characteristics of the participants were investigated using a Demographic Data Questionnaire. It included age, weight, height, exercises type, exercises time, menarche age, number of menstrual cycles in a year, the frequency of menstruation (day) and length of the cycle, duration of menstrual flow (day). The data were collected by a face-to-face survey method.

Pre-Menstrual Distress Questionnaire (MDQ)

All women were asked to fill out a questionnaire which assesses menstrual symptoms to fill out on the three phases of a single menstrual cycle. All the symptoms were analyzed separately in the three phases, and the frequency and severity was contrasted between the phases. The MDQ requires the subjects to rate over 47 symptoms using a five-point Likert type scale (0-4) ranging from "no experience of symptoms" to "very severe".

Scoring and Interpretation

Each item had five options categorized on a 0−4 rating scale with scores as mentioned above. The total score was 188. The level of premenstrual distress was ranged as follows:
0− No experience of symptoms,
1−47: Mild
48−94: Moderate
95−144: Strong
145−188: Severe

Each subject made these ratings separately for the menstrual (during menstrual flow), premenstrual (one week before the beginning of menstrual flow) and inter-menstrual (remainder of the cycle) of her most recent menstrual cycle. The eight scales of the MDQ include: pain (6 symptoms), water retention (4 symptoms), autonomic reaction (4 symptoms), negative affect (8 symptoms), impaired concentration (8 symptoms), behavioral change (5 symptoms), arousal (5 symptoms) and control (6 symptoms). Each scale (8 scales) scores were calculated separately, and then the total scores were calculated.

Statistical Analysis

The data obtained from the research were analyzed in the SPSS version 19.0 package program. Mean and standard deviation were determined for all variables. Normality of the data was calculated by means of the Shapiro-Wilcoxon test, and then non-parametric tests applied. In order to compare the syndrome scores of the exercising group and the sedentary group, the Mann Whitney U test was applied, and for the comparison of menstruation characteristics, the Chi-square test was used.

RESULTS

This study was performed on 220 women between the two different groups: the exercising group and the non-exercising group. General characteristics are given in Table 1.

According to Table 2, in which the mean number for menstruations in a year and the frequency of menstruations was compared between the exercising group and the non-exercising group, no significant differences were found

($p > 0.05$), but significant differences were found for the length of menstrual flow ($p < 0.05$). In the present study, in 83% of the exercising group and 80.8% of the non-exercising group the frequency of menstruation was between 21−30 days, and in 39.2% of the non-exercising group the length of menstrual flow was higher compared to 26.2% of the exercising group.

PMS scores were compared in each menstruation phase, and the premenstrual PMS scores were found significantly higher in the non-exercising group than in the exercising group ($p < 0.01$). Menstrual and inter-menstrual PMS scores were not found significantly different between these two groups ($p > 0.05$) (Table 3). The highest PMS average score was found for the menstrual phase in both groups.

Table 1. Demographic characteristics of the study participants

	Exercising group (n = 100)	Non-exercising group (n = 120)
Age (years)	23.07 ± 4.76	23.05±4.77
Height (cm)	162.3±6.4	162.14±6.27
Weight (kg)	55.92±7.54	56.12±7.21
Menarche age (years)	13.72±1.23	13.8±1.2

Table 2. Menstrual cycle characteristics of the exercising group and the non-exercising group

Menstrual Cycle Characteristic		Exercising group n (%)	Non-exercising group n (%)
Number of menstruations in a year	8 and lower	9 (9.0)	11 (9.2)
	9–11	40 (40.0)	45 (37.5)
	12 and upper	51 (51.0)	64 (53.3)
		P=0.929	
Frequency of menstruation	21–30 day	83 (83.0)	97 (80.8)
	30–90 day	17 (17.0)	23 (19.2)
		P= 0.728	
Length of menstrual flow (days)	2–5 days	74 (74.0)	73 (60.8)
	6 and over	26 (26.0)	47 (39.2)
		P=0.045*	

Table 3. Scores of PMS in each phase of menstruation

Menstruation phases	Exercising group (Mean±SD)	Non-exercising group (Mean±SD)	P value
Premenstrual	29.31 ±20.30	39.41 ±25.52	0.003**
Menstrual	43.40 ±25.45	49.42 ±26.43	0.106
Inter-menstrual	11.75 ±10.35	15.75 ±16.27	0.233

***p<0.001*

The mean and the standard deviation for the eight scales in each phase are shown in Table 4. Water retention, negative affect, impaired concentration, behavioral change, arousal, and control showed significantly higher scores in the non-exercising group than in the exercising group for the premenstrual phase ($p < 0.05$ and $p < 0.01$). There was also a significant difference with

higher scores found in the non-exercising group than the exercising group for the water retention symptom in the menstrual phase ($p < 0.01$) and the arousal symptom in the menstrual and inter-menstrual phases ($p < 0.05$ and $p < 0.01$) In addition, the highest PMS average score was found for the menstrual phase for each scales in both groups.

Table 4. Scores for menstrual syndromes in each scale of menstruation

Scales	Phases	Exercising group (Mean±SD)	Non-exercising group (Mean±SD)	P value
Pain	Premenstrual	6.76 ±5.19	7.53 ±5.21	0.261
	Menstrual	9.56 ±6.16	9.71 ±5.29	0.850
	Inter-menstrual	1.79 ±2.78	2.18 ±3.52	0.654
Water retention	Premenstrual	4.47 ±3.27	6.57 ±3.58	0.000**
	Menstrual	4.92 ±3.43	6.22 ±3.65	0.008**
	Inter-menstrual	1.26 ±2.07	1.79 ±3.03	0.267
Autonomic reaction	Premenstrual	2.14 ±2.62	2.46 ±3.15	0.843
	Menstrual	3.59 ±3.20	3.52 ±3.83	0.375
	Inter-menstrual	0.91 ±3.24	0.88 ±1.89	0.584
Negative affect	Premenstrual	7.52 ±6.54	11.13 ±8.24	0.001**
	Menstrual	11.84 ±7.98	13.07 ±8.28	0.285
	Inter-menstrual	2.38 ±3.73	3.17 ±5.32	0.571
Impaired concentration	Premenstrual	4.45 ±6.07	6.58 ±6.51	0.012*
	Menstrual	7.22 ±7.96	8.49 ±7.91	0.174
	Inter-menstrual	2.04 ±4.38	2.36 ±4.19	0.504
Behavioral change	Premenstrual	4.54 ±4.87	6.05 ±5.18	0.029*
	Menstrual	7.56 ±6.22	8.04 ±5.82	0.441
	Inter-menstrual	1.94 ±3.65	2.18 ±2.91	0.084
Arousal	Premenstrual	2.98 ±3.35	4.20 ±3.85	0.013*
	Menstrual	3.69 ±3.43	5.13 ±4.08	0.008**
	Inter-menstrual	3.03 ±3.78	4.01 ±3.99	0.037*
Control	Premenstrual	3.37 ±3.59	4.46 ±4.06	0.042*
	Menstrual	4.96 ±4.75	5.68 ±4.86	0.226
	Inter-menstrual	1.08 ±2.43	1.43 ±2.38	0.113

** P<0.05 and ** P<0.01*

DISCUSSION

The study examined premenstrual syndromes in an exercising group and a non-exercising group. The two groups' menstrual cycle characteristics, such as the number of menstruations in a year and the mean frequency of menstruations, were found to be similar. However, a significant difference was observed regarding the length of the menstrual flow ($p < 0.05$). A normal menstrual cycle was defined to last for 21 to 35 days, with 2 to 6 days of flow, while an irregular menstruation cycle was asserted to last for <20 or >35 days, with <2 or >7 days of flow [21]. Atan [22] reported that the frequency of menstruation was calculated as 21 to 30 days for 84% of athletes and 87% of non-athletes. In the present study, the frequency of menstruation was found to be between 21−30 days for 83% of the exercising group and 80.8% for the non-exercising group, and the menstrual flow length of 39.2% of the non-exercising group was longer than that of 26.2% of the exercising group.

In this study, the PMS scores were found to be higher in the non-exercising group than in the exercising group in the premenstrual phase. However, no significant difference was found in total PMS scores of the two groups during the menstrual and inter-menstrual phases. A quasi-experimental study demonstrated that the mean PMS scores and symptoms declined after 8 weeks of aerobic exercise training in the experimental group and suggested that aerobic exercise could be used as treatment [23]. The study conducted by Khademi et al. [12] showed that 6 months of swimming as an aerobic exercise could reduce physical and psychological symptoms of PMS. Similarly, Dehghan et al. [24] observed that 3 months of aerobic exercise reduced physical and psychological symptoms effectively. Some studies proved that doing more physical activity improves the severity of symptoms within 3 months of starting an exercise program [25, 26, 27]. Despite the potential biological connections, such as release of endorphins into the body by physical activity [13, 28, 29], decreased levels of sex hormones [30, 31], improvement in oxygen levels in the muscles [30] and a decrease in cortisol levels [30], studies remain largely inconsistent in linking physical activity to reduced premenstrual symptoms. Previous studies and the results of this study have supposed that regular physical activity prevents premenstrual symptoms from developing and improves existing monthly symptoms [17].

In the present study, the prevalence of each scale scores of the exercising and non-exercising groups was compared. Water retention, negative affect, impaired concentration, behavioral change, arousal and control scales have got different mean scores in the two groups ($p < 0.05$ and $p < 0.01$). The present study results showed that the pain scores of the two groups were not significantly different. However, the pain scores were found higher in the non-exercising group than in the exercising group in premenstrual, menstrual and inter-menstrual phases.

Dysmenorrhea is defined as the presence of painful cramps in the uterine that occur during menstruation and represent one of the most common causes of pelvic pain and menstrual disorder [32]. Behavioral interventions, such as exercise, may not only reduce dysmenorrhea but also eliminate or reduce the need for medication to control menstrual cramps and other associated symptoms [33]. Some studies revealed a positive relationship between dysmenorrhea and PMS [5, 34, 35]. The effect of exercise may be related to the release of endorphins in the body, which can improve premenstrual symptoms by alleviating the depressive or anxious feelings [29] and counteracting possible declines in endorphin levels in the luteal phase [14, 36]. Nonetheless, some researchers have found no relationship between dysmenorrhea and PMS [37]. Similar results were found in this study as well, and the findings of this study support previous reports. The pain scale results concluded in this study are different than those of the aforementioned studies which reported no significant difference between PMS scores of exercising and non-exercising groups. In this study, on the other hand, the water retention scale score showed a significant difference between the two groups. The water retention scores of the non-exercising group were higher than those of the exercising group in premenstrual and menstrual phases, and the difference was statistically significant ($p < 0.05$). Regular aerobic physical activity with moderate and high intensity decreases edema symptoms (swollen breasts, bloating and overweight) of PMS [38]. Researchers have shown that physical activity reduces the levels of renin activity, increases the estrogen and progesterone levels and thus decreases the serum levels of aldosterone and reabsorption of sodium

and water, thereby reducing edema and improving physical symptoms [23]. Another study conducted by Tsai et al. [39], in which participants completed 12 weeks of yoga practice, showed that the level of edema, body water and extracellular water were reduced immediately after the yoga class. This result demonstrates that yoga exercise can alleviate edema in a very short period of time. This study confirmed that regular aerobic exercise reduced the water retention symptoms.

The results of this study proved that there was no significant difference between the two groups regarding their autonomic reaction scores. Autonomic reactions consist of four symptoms: dizziness (or faintness), cold sweats, nausea (or vomiting) and hot flashes [40]. Bayram [41] comparedPMS symptoms observed in basketball players and sedentary females. She found out that the autonomic reaction scores of basketball players were higher than those of sedentary females in inter-menstrual phases. However, Aganoffand and Boyle [28] stated in their study that autonomic reactions did not differ significantly between exercisers and non-exercisers. In this study, negative affect scores were higher in the non-exercising group in the premenstrual phase, and the difference was statistically significant ($p < 0.01$). That is to say, the non-exercising group was more depressed than the exercising group. The previous study showed that the most common complaints in the negative affect scale were depression, tension, mood swings, anxiety, anger, and fatigue [42, 43]. Physical activity ensures the release of endorphins into the body, which can improve premenstrual symptoms by alleviating depression and anxiety [29, 44]. Exercising reduces negative feelings, induces positive thoughts and alleviates depression in the short run [28]. Studies showed that pharmacological and psychological treatments would be effective in treating depression; however, some people choose alternative treatments, such as exercising [45, 46]. Ghanbari et al. [47] studied the effect of three months of regular aerobic exercise on premenstrual syndrome in two groups which consisted of non–exercising ($n = 48$) and exercising ($n = 43$) women, respectively. The results asserted the positive effect of exercise on psycho-emotional symptoms. The present study confirms the results of previous investigations and that regular exercise decreases the negative effects. In the current study, impaired concentration scores were lower in the exercising group in the premenstrual phase, and there was a significant difference between the two groups regarding their impaired concentration scores ($p < 0.05$). Aganoffand and Boyle [28] examined the effects of regular moderate exercise on mood states and menstrual cycle symptoms of regularly exercising ($n = 97$) and non-exercising ($n = 159$) women. Regular exercisers got significantly lower scores on impaired concentration. Bayram [41] concluded that the impaired concentration scores of sedentary females were higher than those of basketball players. The results showed that regular exercise improved impaired concentration. In another study, it was deduced that athletes got lower impaired concentration scores in comparison with non-athletes; however, the difference between the two groups was not significant [22]. In this study, behavioral change scale scores of the exercising group were lower than those of the non-exercising group, and the difference between the groups was significant in the premenstrual phase ($p < 0.05$). Ghanbari et al. [47] found out that after completing 3 months of regular aerobic exercises, the behavioral change scores were lower in the exercising group than in the control group. The behavioral change symptoms are as follows; low school or work performance, taking naps or staying in bed, staying at home (absenteeism), avoiding social activities, decreased efficiency and change in eating habits/craving for sweets [11]. The other scale scores addressed in this

study were arousal and control scores. The differences between the groups regarding these scores were significant. The arousal scores were lower in the exercising group compared to the non-exercising group, and the difference was significant in premenstrual, menstrual and inter-menstrual phases ($p < 0.05$ and $p < 0.01$). Furthermore, the control scores were found to be higher in the non-exercising group than in the exercising group, and the difference was significant in the premenstrual phase ($p < 0.05$). In the study conducted by Bayram [41], it was deduced that arousal scores of sedentary females were higher than those of basketball players. That being said, she also found out that the control scores were higher in sedentary females than in basketball players. Yet, Atan [22] concluded that the arousal scale scores were low in both groups. However, these scores were higher in athletes than non-athletes in premenstrual and menstrual phases, and the control scores were higher in non-athletes, which was rather interesting. The findings of the present study, similarly to previous studies [39, 47, 48], proved that regular exercise improves PMS symptoms in women in comparison to being sedentary.

CONCLUSIONS

This study showed that regular aerobic exercise reduces and improves PMS symptoms in sedentary women. The results of this study encourage regular aerobic exercise as a potential intervention for PMS. Physical activity may be recommended as a method for reducing the risk of PMS and its severity and as an alternative to pharmaceutical treatments, since regular aerobic physical activity improves cardiovascular, hormonal and neuromuscular functions, and it may minimize systemic dysfunction in women during the premenstrual phase of the menstrual cycle.

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