Original Article

The effects of 8 weeks of regular aerobic exercise on the symptoms of premenstrual syndrome in non-athlete girls

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Abstract

Background: Premenstrual syndrome (PMS) is a combination of physical, psychological, or behavioral changes in the late secretary phase of menstrual cycle and interferes with interpersonal relationships or activities.The purpose was to assess the effects of 8 weeks of regular aerobic exercise on PMS in non-athlete girls.

Materials and Methods: This quasi-experimental study was conducted on 40 non-athlete girl students aged 18-25 years at Khorasgan Azad University, with a diagnosis of PMS. The instruments included personal information and a medical questionnaire, a form of premenstrual symptoms DSM-IV, the GHQ 28 questionnaire, and the Beck Depression and Anxiety questionnaire, and also, daily symptoms were recorded for 4 months (two courses before the training period and two during training). Individuals in the experimental group practiced aerobic exercise for 8 weeks, three sessions per week for 60 min. The subjects were evaluated during the first (the pre-test), second (the mid-test), and third menstrual period (the post-test).Statistical analysis used in this study is *t*-test and repeated measurement analysis of variance (ANOVA).

Results: Results showed that the mean scores of PMS and symptoms declined after 8 weeks of training in the experimental group. The comparison of the two groups showed that the mean scores of PMS, for symptoms during and after exercise, were significantly different ($P \leq 0.001$) and the percentages of scores PMS changes, physical, and psychological symptoms of experimental and control groups had a significant difference ($P \leq 0.001$) after 8 weeks of training.

Conclusions: Overall, the findings showed that 8 weeks of aerobic exercise is effective in reducing the symptoms of PMS and can be used as a treatment.

Key words: Aerobic exercise, Iran, non-athlete girls, premenstrual syndrome

Introduction

Cyclical nature of women's reproductive functions is a natural part of their lives and produces some physical and psychological functions.[1] One of the psychosomatic problems that is associated with female reproductive function is premenstrual syndrome (PMS) which is an aggregation of physical–mental or behavioral symptoms occurring in the late luteal phase of menstrual cycle; on average, it starts 5-7 days before the beginning of menstruation and 2-4 days after the onset of monthly bleeding. This cycle continues repeatedly.[2] PMS, which affects millions of women, has been recognized as a major disruption.[3] This is because 40 million women in the world suffer from the symptoms of this syndrome and more than 5 million of them are going on to medical treatment for mental and behavioral changes this syndrome causes.[4] Researches carried out in Iran have reported the prevalence of this syndrome as 62.4% and 67.7%.[5,6] Clinical and psychological symptoms of this common syndrome include depression, irritability, abdominal cramps, breast tenderness, headaches, isolation, and performance reduction.[7,8] Although the exact cause of this syndrome is almost unknown, the changes of ovarian steroid levels, vitamin and mineral deficiencies, disorders in the path of renin–angiotensin–aldosterone, increased prostaglandins and prolactin, age, and genetics have been mentioned as risk factors.[7,9] Women with PMS compared with women with no history of PMS need care, higher medical treatment, and the possibility of absence from work.[10] The syndrome brings forth familial consequences such as conflicts and controversies and discomfort among couples, which necessitate addressing and providing effective treatment strategies. Since the cause of this syndrome

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is unknown, the proposed treatments are different. At present, no cure for PMS is known.[10] In this way, treatment includes medication (antidepression tablets, vitamin B, etc.) and surgery (removal of ovaries), and alternative non-pharmacological treatments (exercise, massage, therapy, etc.) have been proposed.[11]

Considering the side effects of drug treatments and surgery, non-drug treatments, particularly physical activity, has attracted the attention of professionals and women.[12] It seems that physical activity affects the mechanisms of brain endorphins and improves mood symptoms. Physical activity by increasing endorphins and reducing the symptoms of adrenal cortisol leads to the improvement of PMS (increased pain tolerance, anxiety, depression, etc.).[10] Considering that physical activity compared with medical treatment is without side effects and has no risks, it is more suitable in this context and it was surveyed for the first time in 1993 by Johnson. The relationship between physical activity and changes in menstrual periods and the reproductive system and the positive effect of physical activity were observed in some studies.[11,13] The results of most studies showed that physical activity can improve PMS symptoms.[14-17] In 1998 in America, a survey was conducted during which a change in diet and physical activity, as important treatments of PMS, were introduced, and walking, swimming, and jugging were considered as the best physical activities.[18]

Khademi (2008) conducted a study on 280 students in order to assess the students' PMS symptoms between swimmer and non-swimmer girls; after the training, the incidence of irritability, a tendency to eat more than usual, agitation, anger, and physical symptoms of breast swelling were observed to be significantly reduced in swimmers.[19]

Pablo (2011) investigated the effects of 8 weeks of aerobic training on 82 women with moderate depression. His results showed that aerobic exercise as a treatment can be used to reduce symptoms in patients with moderate depression.[20]

Considering the high prevalence of PMS among women and girls, and the complications of this syndrome on job performance, social and interpersonal relationships and family, and the role in limiting the phenomenon of educational, social, and economic progress in the community, this study aimed to compare the effects of 8 weeks of aerobic training on the severity of PMS in non-athlete women and girls in order to improve their health and capabilities.

Materials and Methods

The present research is an applied review with a quasi-experimental design, with pre-test–mid-test–post-test and control groups. The population for this study consisted of all female students of 18-25 years of age studying at the Islamic Azad University, Khorasgan branch. The inclusion criteria were: Females aged between 18 and 25 years, single, with regular menstrual periods, bleeding between menstrual cycles of length of 22-35 days for 3-8 days. The exclusion criteria were: History of regular physical activity for 3 months before starting the study and during the study; history of diseases such as asthma, diabetes, renal, cardiac, psychiatric, thyroid, epilepsy, or on medication, or being on a special diet; and syndrome identification based on PMS standard option complaint check list (or the checklist of 30 standard cases).[21] Those with less than 30 points from the list were considered as mild PMS and those with more than 30 were considered as moderate to severe PMS. In this study, people who scored 30, had moderate to severe PMS, had the symptoms 7 days before menstruation and for the first 4 days of the menstrual cycles in the recorded daily, were asymptomatic for the rest of the period, scored below 21 in the General Health Questionnaire (GHQ) 28 (0-21),[22] and had one score below 4 in the Beck Depression Inventory (0-4) and one score below 7 in Beck Anxiety Inventory (0-7) were selected as research subjects. The researcher then attempted to obtain written consent from them, and used a calendar to record daily symptoms for four cycles (two pre-training courses and two during the training) and asked them to complete it from the first day of the cycle in the manner that the researcher explained. At the end of the second cycle, the researcher collected the data which were completed by the subjects, and after confirming, 40 cases were divided by a simple random procedure into two groups (aerobic training 20 N and control 20 N). In the next stage of research, the nutritional guidelines were provided to the subjects in a form.

Exercises were done over a period of 8 weeks, as 3 sessions in a week with 60 min for each session in the presence of an experienced trainer. In the first place, for about 5 min warm-up and stretch was performed, then the rapid movements of the limbs and trunk in a combined manner were done for 50 min, and at the final 5 min, light stretching was done to go back to the original state. Once a week, and also to increase the intensity, hand weights were used. The first week of training was equivalent to 60% of the maximum heart rate (HRmax) which progressively increased so that the work in the last session was 80% HRmax. This exercise was performed between the two menstrual cycles. The control group did not do any exercise training in this period. After a month of training, the questionnaire was distributed among the subjects of the two groups and they completed it according to their characteristics and situations (the mid-test) and the practice continued in

the second month. At the end of the second month, the questionnaire was distributed among the subjects and the post-test was performed.

The data analysis was done by SPSS software and then the data were analyzed using descriptive and inferential statistics. Descriptive statistics indicators such as mean and standard deviation and inferential statistics indicators like the independent *t*-test were used in order to compare variables in two independent groups and to compare each group before, during, and after the test. Analysis of variance (ANOVA) was used with repeated observations. $P < 0.05$ was considered as the significance level.

Results

The mean age of subjects in aerobic and control groups was 20.70 and 20.85, respectively; the mean age at menarche was 12.85 and 13.05 years, respectively, and the mean body mass index (BMI) and mean age of the subjects were 22 and 21.50, respectively. The *t*-test showed that the mean age at menarche and BMI in the two groups before the intervention had no significant difference. Table 1 shows the effects of aerobic training program on reducing physical and psychological symptoms of PMS in the experimental group. As it can be seen, in this group, mean PMS, physical, and psychological symptoms before, during, and after the intervention showed a significant difference ($P \leq 0.001$).

Also, paired *t*-test showed that the mean PMS, physical, and psychological symptoms in aerobic exercise during exercise was less than that before exercise and it was also lower than that during exercise ($P \leq 0.001$).

This study also showed that the mean percentage score changes of PMS, physical, and psychological symptoms during exercise were not similar before exercise and after exercise in both groups ($P \leq 0.001$) [Table 2].

The results of this survey showed that the physical and psychological symptoms of experimental and control groups after 2 months of training had a significant difference ($P \leq 0.001$). As it is shown in Table 2, after 4 weeks of aerobic exercise, overall, 31% of PMS, 29% physical symptoms, and 33% psychological symptoms were reduced, and after 8 weeks this reduction rate became 60%, 65%, and 52%, respectively. These findings indicate the impact of aerobic exercise in the first 4 weeks on the reduction of PMS symptoms, i.e., with 4 weeks of aerobic exercise, it can be expected that PMS symptoms be reduced. But the reduction of PMS symptoms after 8 weeks was significant and better than that observed after 4 weeks. However, the persistence of this demands further investigation.

Discussion

In this study, the positive impact of 8 weeks of regular aerobic exercise on physical and psychological symptoms of PMS was observed in female non-athletes. The findings of this study reveal a positive effect of exercise on PMS symptoms, which is consistent with the studies showing that aerobic activity is effective. Khademi *et al.*'s study (2008) showed that 8 weeks of swimming as an aerobic exercise can reduce the physical and psychological PMS.[19] Dehghan *et al.* (2008) also observed that 3 months of aerobic exercise reduces the physical and psychological symptoms effectively.[11]

Also, some studies showed that regular aerobic exercise has many benefits, including increased power for women's heart vascular activity, increasing the bone density, and reducing the stress and PMS.[23] Physical symptoms such as swelling,

Table 1: The mean scores of PMS, physical, and psychological symptoms of groups before, during, and after intervention

Mean score	Group	Pre-test		Mid-test		Post-test		Insignificant	
		Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	F	*P* value*
PMS	Aerobic	48.05	12.61	31.80	8.60	18.75	6.70	77.66	<0.001
	Control	46	12.30	47.10	9.55	47.95	9.02	0.61	0.55
P value		0.56		<0.001		<0.001			
Physical symptoms	Aerobic	23	7.80	15.55	5.50	7.25	2.07	44.40	<0.001
	Control	21.50	7	21.70	5.62	2.60	5.61	0.97	0.39
P value		0.50		<0.001		<0.001			
Psychological symptoms	Aerobic	25.10	6.60	16.20	5.40	11.50	5.45	33.45	<0.001
	Control	24.45	7.90	25.40	7.60	25.35	7	0.86	0.43
P value		0.76		<0.001		<0.001			

*Comparison of one variable mean in a group at different times, PMS: Premenstrual syndrome

Table 2: Percentages of scores in PMS, physical, and psychological symptoms of groups before, during, and after intervention

Mean of change in percentages	Group	Change in percentages before and during exercise		Change in percentages before and after exercise	
		Mean (%)	Standard deviation (%)	Mean (%)	Standard deviation (%)
PMS	Aerobic	−31	17	−60	14
	Control	04	13	07	18
P value		<0.001		<0.001	
Physical symptoms	Aerobic	−29	18	−65	14
	Control	04	18	10	23
P value		<0.001		<0.001	
Psychological symptoms	Aerobic	−33	23	−52	23
	Control	05	12%	07	22
P value		<0.001		<0.001	

PMS: Premenstrual syndrome

weight gain, headaches, and breast pain are possibly related to increased aldosterone in serum, prostaglandin E_2, and deficiency of vitamin B and Mg. Increased level of prolactin in the late luteal phase is one of the causes of breast pain and swelling, and possibly aerobic exercise in non-athletes reduces the level of this hormone, and thus may reduce the symptoms.[18]

Increased renin–angiotensin activity and decreased levels of estrogen and progesterone as factors in increased serum levels of aldosterone in the late luteal phase are listed,[14,24] and increased level of aldosterone in the serum increases the reabsorption of sodium and water, and as a result causes edema and physical symptoms.[18]

Researches show that the performance of physical activities reduces the levels of renin activity and increases the levels of estrogen and progesterone,[23] and in this way, decreases the serum levels of aldosterone and reabsorption of sodium and water, thereby reducing edema and improving physical symptoms. A survey conducted by Joyner and Charkoudian (2004) on 20 women showed that the 12-week aerobic exercise created the balance of estrogen and progesterone levels in women, reducing the symptoms.[25]

Another factor in the emergence of physical symptoms is increased prostaglandin E_2,[18] which reduces muscle contractions. The repetitive contraction in the aerobic exercise helps venous blood to return, resulting in the increase of prostaglandins and other substances which help prevent and reduce back pain and discomfort in the pelvis and the abdomen.[26] The effect of regular physical activity is the reduction of norepinephrine hormone levels at rest, which in turn can cause reduced heart rate and blood pressure at resting time.[27] In this study, the positive effects of aerobic exercise on psychological symptoms were observed. Scully (1998) showed that 12 weeks of exercise (aerobic and non-aerobic) is effective in reducing PMS, but aerobic activity can reduce depression more.[28]

Pablo (2011) considered 8 weeks of aerobic exercise as a treatment for reducing symptoms in patients with moderate depression.[20] Girman's study (2003) showed that 6 months of regular physical activity can reduce anxiety.[27] Noting that beta-endorphins levels in the late luteal phase decrease due to changes in sex hormones, it seems that physical activity with influences on brain endorphins improves the psychological symptoms.[10] Aganoff (1994) believed that aerobic activity through an increase in brain endorphin and reduction of adrenal cortisol results in the improvement of PMS symptoms and psychological symptoms that may occur due to reduced beta-endorphins.[29] The positive effects of exercise on psychological symptoms are also justified by others. According to the cognitive–behavioral theory, intrusive thoughts and cognitive impairment lead to depression. Exercise results in the elimination of negative thoughts and brings about positive thoughts, and thus it can reduce depression for some time.[29] Also, stress and anxiety are produced due to lack of confidence in people; on the other hand, exercise causes collective social contacts and people increase their self-image and confidence, and as a result, stress and anxiety are reduced.[29] Another possible mechanism is the effect of exercise on blood leptin levels in women with PMS.[10] Leptin is a hormone secreted from fat cells and regulates the metabolism of the hypothalamus–pituitary–gonadal and has an important role in human reproduction. This hormone exerts its metabolic and neuroendocrinologic effects through its receptors in the hypothalamus area of emotional control. A study has shown that circulating leptin concentration in women with PMS is significantly higher than in women without PMS, and high hormone levels may be associated

with psychological symptoms of PMS.[30] Some researches showed that physical activity reduces the amount of leptin in blood to 30-34%.[31,32] Perhaps physical activity by decreasing the blood leptin levels in women decreases the psychological symptoms of PMS.

In this study, the mean score of psychological symptoms had a significant difference before, during, and after the intervention.

Overall, the findings of this research show that aerobic exercise training to patients suffering from PMS can reduce symptoms, resulting in better job and social performance. It can be recommended as an effective treatment method. Since this syndrome can have a negative impact on the employment and the performance of women and can cause economic damage, this method is recommended to improve other aspects of women's health as well.

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