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Effect of Two Intensity of Aerobic Exercise on Clinical Symptoms of Premenstrual Syndrome in Fertile Women

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Abstract: About 3% to 8% of women have symptoms that are severe enough to disrupt their home and society responsibilities. Varied therapeutic treatment has been studied. The aim of this study was to determine two different intensity of regular aerobic training on clinical symptoms of PMS. This study was a kind of semi experimental study, after the announcement and call for research based on questionnaires about symptoms of PMS (negative mood, discomfort and edema), 90 women with mean age (27.1±10.96) who are eligible to participate in this study were selected. All subjects with premenstrual syndrome and had no history of any disease. These subjects were divided into three groups. High-intensity exercise group (n=30), moderate-intensity exercise group and the control group (n=30), which did not participate in any sporting activity. After three months and three physical activity sessions per week, symptoms were evaluated again in 3 groups. In this study, Manova was used for statistical analysis. The symptoms after three months of regular aerobic exercise, in the two experimental groups decreased and the amount of the reduction in the two groups did not differ. BMI does not influence on incidence rate of pms (p=0.0001). Recent research shows that regular aerobic exercise is effective in reducing PMS symptoms.

Key words: women · Premenstrual Syndrome · Aerobic exercise · Clinical symptoms

INTRODUCTION

The diagnostic definition for PMS established by the American College of Obstetricians and Gynecologists (ACOG), states that symptoms must be present in the 5 days before a woman's period for at least three menstrual cycles in a row and end within 4 days after her period starts [1]. Symptoms must interfere with normal life activities and may cause impairments in work performance, family and social activities and sexual relationships [2, 3] and should be documented prospectively for at least two cycles [4].

It is estimated that up to 85% of women who menstruate experience at least one premenstrual symptom, occurring within the two weeks before menses and easing after menstruation begins [1, 4]. When symptoms are severe, as is the case among the 5–10% of women with premenstrual syndrome (PMS), the effects can be substantial [5]. Severe premenstrual distress has been linked with decreased productivity at work, absenteeism and deterioration in personal and family relations [4, 6, 7] and, in the extreme, violence [8].

Statistics show that 40 million women suffer from this syndrome and more than five million of them use medical treatment for mental and behavioral changes [9].

More than 160 PMS symptoms have been associated with the premenstrual phase of ovarian cycle [3] that includes the physical, emotional and behavior symptoms [1].

Physical symptoms include: fatigue, abdominal bloating and pain, edema, breast edema and pain, backache, headaches, stomach – bowel symptoms, constipation, muscle cramps, heart palpitations, dizziness, acne cyclic, weight gain, pelvic pain... Emotional symptoms include: irritability, fatigue, stress, anxiety, depression, forgetfulness, insomnia, changes in sexual desire, lack of concentration... And behavioral symptoms include: mood changes, overeating, Increase in appetite at unusual hours, high irritability, sadness, crying easily, isolationism, etc … [1].

The real causes of PMS are not clearly known. Many theories have tried to justify the various manifestations of PMS, but so far, no single theory has been able to gain widespread acceptance. Many of the early theories lacked

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biological justifications and seemed to serve a commercial purpose. Recently, the relationship between ovarian steroid levels and centrally acting neurotransmitters such as Serotonin is one of the tentative theories, discussed and studied.

Other evidences obtained from research studies suggest that the disorder is related to changes in magnesium and calcium serum levels, impairment of rennin-angiotensin-aldosterone pathway, other endocrine disorders and finally the genetic map and life style of the individual seem to play a role in etiology of PMS [2]. Having a genetic predisposition (mother - daughter and twins) in specific PMS symptoms have been studied and their role has been confirmed in numerous studies [3]. Some of the foods such as chocolate, alcohol, sugary drinks and vitamin B6 in PMS symptoms were tested, but results of these studies are inconclusive [10].

In view of this fact that PMS reduces life quality of many women [11] and has significant effects in reducing the general safety and quality of life, of the female disrupting her function at work while inducing health costs, mandates appropriate consideration to be taken for treatment guidelines for this syndrome. In this context, different treatment methods are discussed, each of which is to counter some etiology [12].

More than 300 different treatments for PMS symptoms have been suggested [13]. Treatments include: medication, surgery, non-drug treatments and the alternative and ultimately physical exercise and sports have been proposed. Considering their side effects, medical and surgical therapies are used only in severe cases of PMS and in the case of no response to other therapeutic treatments. Hence, non-drug therapies and exercise have received more attention by researchers and afflicted women [2].

In 1994, Aganoff and Boyle studied the effect of moderate aerobic exercise on mood states and menstrual cycle syndromes in two groups of exercising (n=97) and non-exercising (n=154) women[14]. The results showed a principal role of regular exercising in decreasing negative feelings such as anger, sin, disgust and pain.

Participation in regular physical activity increases mental and physical health,which bears practical benefits for women. Regular physical activity can reduce psychological morbidity and anxiety can be relieved through exercise [15]. Scully *et al*. (1998) showed the positive effect of exercise on psychoemotionalon symptoms of PMS including depression and anxiety [16].

An examination of the studies in this regard show benefits of physical activity in women's health including the reduction or elimination of many PMS symptoms [14, 17] but a study conducted by Kritz *et al*. (1999) no relationship between physical activity and decreased PMS symptoms [18].

Kroll *et al*. (2010) too reported that their research results do not support significant relationship between exercise and symptoms of PMS [6]. Likewise, Barnhart *et al*. (1995) stated that, although aerobic exercise do have a positive outcome on general health, but with no specific effect on PMS symptoms [19]. Research conducted by Margays and Gomes. (2002), on two groups of athletes and non athletes shows that regular exercise reduces some PMS symptoms such as headaches and irritability but does not show to have an effect on other symptoms of PMS [20]. Two other studies, in particular showed an increase of PMS symptoms among women athletes [5, 21]. Although aerobic exercise as a means to control the symptoms of PMS have been recommended and proven in a large number of studies, the question is, whether regular aerobic exercise with moderate intensity (of about 60% to 65% heart rate maximum) and high intensity (of about 80% to 85% Maximum heart rate) on clinical symptoms of PMS in subjects, can indeed be effective? And basically is there a connection, between BMI and symptoms of PMS in subjects under study?

MATERIALS AND METHODS

Subjects: An invitation of participation was issued by the Tonekabon Brunch of the Islamic Azad University in which 150 women in the child-bearing age attended. A standardized questionnaire to collect data regarding recordings of PMS symptoms was distributed. The validity and reliability of the questionnaire had already been established [22, 23]. It should be noted that the face and content validity of the questionnaire, with respect to standardization was obtained through authority approval and its previous practicality in other studies. The mean and the internal reliability of the questionnaire was calculated using Cronbach's alpha of 0.81.

Then, based on the criteria of the standard questionnaire, 90 women had PMS symptoms and satisfied the entry criteria. They were randomly divided into three groups and signed the volunteer disclosure form to participate in the study for a duration of three months. As the first step, the filling in of the questionnaire in the correct way was instructed.

We particularly pointed out to midwifery experts not to mistaken the PMS with dysmenorrhea. The participants, according to the midwife's report had regular menstrual cycles of 23-35 days. Demographic characteristics of participants including their age, weight, height, marital status, educational level, the onset age of menarche, duration of menstrual bleeding and medical history were respectively recorded.

Research Criteria for Entry and Exit of Subjects: The criterion of being included in the research consists of having PMS with different intensities based on daily record of PMS symptoms. Lack of thyroid diseases, obstetrics and gynecology disease, diabetes, no medication (antidepressants, hormones and vitamins), no accident in the last three months like relatives` death, marriage or surgery, are among criteria for entering to the research.. All of the patients had regular menstrual cycle of 23-35 days. None of them had any psychiatric disorder as determined by the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders. None of the subjects was pregnant. Married subjects used non-hormonal contraception methods. Participants were in good general health as determined by medical history, physical examinations and complete blood test.

Exclusion criteria consisted of irregular menstruation, high blood pressure, blood fat, kidney or liver diseases, bone diseases such as osteomalacia, digestive disorders, rheumatoid disease, multiple sclerosis, cancer, diabetes type 1 or 2, Polycystic ovaries, Hyperparathyroidism and use of corticosteroids (like prednisone, anabolic steroids, anticonvulsants, cimetidine and propranolol).

Physiological Measures: BMI is obtained through the following formula.

$$BMI = \text{Weight (kg)} / \text{height } (m^2)$$ (table 1).

Table 1. showed the body mass index (BMI) of subjects in four groups.

First, by applying formula 208- (0.7age), maximum amount of heart beats for each subject was measured [24]. The intensity of physical activities for both intensities was controlled by using Polar wrist heart monitor.

Measuring PMS: To determine PMS in subjects, we used the criterion of ACOG. The diagnosis of PMS requires that symptoms be confined to the luteal phase.

Table1: BMI (according WHO[1]) BMI (Kg/m^2)

Under weight	<18.5
Normal weight	18.5-24.9
Overweight	25-29.9
Obesity	>30

By assessing the completed daily symptoms calendar, we can determine whether the patients` symptoms follow the cyclical pattern or not. Symptoms which are not confined to the luteal phase do not represent PMS and instead may indicate another disorder [1, 25]. Therefore, the presence and intensity of PMS are determined and confirmed by a modified version of standard questionnaire for assessing symptoms of menstrual disorders. This questionnaire was supposed to be filled by subjects within three forthcoming menstrual cycles. At the end of appointment, participants were assured that all of their information would be kept confidential.

Based on questionnaire questions, PMS symptoms were studied in several groups:

- Negative mood symptoms: considerable depression, feeling of hopelessness, considerable stress, excessive tension and agitation, considerable emotional fluctuations (sudden sadness, tearing or increased sensitivity to stimuli), considerable anger and irritability or increased interpersonal conflicts, decreased interest in daily activities (work, lethargy, early fatigue or lack of significant energy).
- Distress symptoms: significant changes in appetite, overeating or specific food appetite, insomnia and other physical signs such as breast sensitivity, headache, muscle and joint pain, stomach and abdominal pain, back pain, constipation, stomach - bowel symptoms, heart palpitations, dizziness, acne, pelvic pains.
- Edema symptoms: swollen breasts, bloating, edema and overweight.

For determining the severity of PMS, four grades by applying Likert scale were used. In this scale, each mark will be displayed from zero to three.

Zero: the lack of signs.

- Mild signs (existing physical and behavioral symptoms, do not affect woman’s daily activities at home and job are not significant).
- Average signs (PMS symptoms are significant, interfere woman’s activity and need medication).

[1]World Health Organization

- Sever signs (the disturbance completely interrupts woman's daily activity).

People with one physical symptom and more than one emotional symptom (negative mood) would be recognized as suffering from PMS [4, 12].

Training Programs: Participants in first experimental group, three sessions in a week and each session 50 minutes, performed aerobic exercises with intensity of 80 to 85% maximum heart rate. Second experimental group had the same training program, except in the amount of intensity which was with 60 to 65% maximum heart rate. Control group didn't take part in any sport activity. Research lasted for three months.

Aerobic exercises consisted of combinational movements. In exercises with high intensity, 10 minutes warm up alongside stretching movements and 30 minutes fast moving of organs and trunk in sports like running, cycling and treadmill were completed. The last ten minutes was allocated for cooling process, including light and stretching movements. Exercises with moderate intensity include 10 minutes warm up, 30 minutes jogging and 10 minutes of cooling. Time of exercises was between 5 to 7 pm. Exercise specialists supervised each session and recorded heart rates with heart rate monitors.

Statistical Analysis: After gathering data, in addition to descriptive statistics, Manova analysis was used to consider research hypotheses. Data analysis was performed by SPSS 18 software.

RESULTS

This study was performed on 90 women being in their pregnancy period. General characteristics of testables are presented in Table 2.

Measured statistical indices for negative mood, discomfort and edema are illustrated in Table 3.

The first finding showed that aerobic exercise with high intensity has effect on negative mood, discomfort and edema resulting from PMS. Difference between experimental group (high intensity) and control group was meaningful.

The other finding indicated that aerobic exercise with moderate intensity has influence on discomfort, negative mood and edema resulting from Premenstrual syndrome. In this case, difference among experimental and control groups was meaningful.

It was clarified that there is no correlation between regular aerobic exercise with moderate intensity (about 60 to 65% maximum heart rate) and aerobic exercise

Table 2: Characteristics of study and comparison population*

	Groups				
Characteristic	High Intensity Endurance	Low Intensity Endurance	Control	F	P
Age(y)	27.1±10.98	26.8±5.96	30.1±12.15	3.787	0.26
Weight(kg)	65.28±14.9	64.8±12.43	65.93±23.72	0.119	0.888
Height(cm)	160.6±13.8	159.63±11.72	161.53±17.84	0.484	0.618
Heart Rate(per/min)	72.2±2.98	70.2±4.5	71.5±4.8	6.804	0.002
BMI(Kg/m^2)	25.52±7.13	25.67±6.02	25.47±8.04	0.026	0.975

* Data are given as mean±standard deviation unless specified otherwise.

Table 3: Measured statistical indices for negative mood, discomfort and edema

	Groups	N	Mean±SD Before exercise	Mean±SD After exercise
Negative mood	High Intensity	30	2±0.643	o.83±0.699
	Low Intensity	30	2.07±0.521	0.9±0.803
	Control	30	1.93±0.691	1.7±0.794
Discomfort	High Intensity	30	1.7±1.149	1.13±1.008
	Low Intensity	30	1.9±0.607	0.7±0/7497
	Control	30	1.63±0.964	1.4±0.855
Edema	High Intensity	30	1.8±0.887	1±0.83
	Low Intensity	30	1.47±0.73	0.63±0.765
	Control	30	1.33±1.028	1.3±0.877

with high intensity (about 80 to 85% maximum heart rate) regarding symptoms of PMS (negative mood, discomfort and edema).

There is no relation between prevalence of PMS and BMI of testables.

DISCUSSION

In this study, the effect of two different intensities- high and moderate- of regular aerobic training on clinical symptoms of PMS was evaluated and confirmed the results of several previous studies about the positive effects of regular aerobic exercise on PMS [2, 25].

Researchers offered mechanisms regarding operation and effect of physical activity on clinical symptoms of PMS. According to these mechanisms, physical activity and training, by affecting main neurotransmitters like serotonin and gamma amino butyric acid (GABA), contribute to reduction of estrogen [22, 27], increased level of beta-endorphin and finally improvement of negative mood symptoms [2, 14, 16].

Beta-endorphin is a neurotransmitter, neurohormone and a regulator of nervous system that its effectiveness is five to ten times more than morphine. Beta-endorphins has a regulatory effect on different hypothalamic functions, including fertility, temperature, cardiovascular and respiratory functions as well as external functions of hypothalamus, such as understanding pain and mood. Regular aerobic exercises change the amount of beta-endorphin from minimum in menstrual bleeding to maximum in luteal phase [12]. Although, in this study, the amount of beta endorphins wasn't measured, but due to being one of the important factors, it is necessary to maintain its characteristics. In the present study, symptoms of negative mood (depression, anxiety, tension, anger and fatigue ...), after 3 months of regular aerobic training in both moderate and high intensities, were improved. This finding is in accordance with the previous studies [14, 16, 17].

According to cognitive-behavioral theory disturbing thoughts and cognitive disorders cause depression and exercise declines negative feelings and induce positive thoughts and reduce depression in short time [14]. Scully D, *et al*. (1998) showed the positive effect of exercise on emotional and psychological symptoms of syndrome, such as depression and anxiety [16].

This study confirmed that regular aerobic exercise with moderate and high intensities reduces discomfort symptoms (significant changes in appetite and sleep, breast sensitivity, pain, heart palpitations, sexual orientations) presented in the PMS.

Impaired prostaglandin levels in late luteal phase decreases libido. Improved libido state after 3 months regular aerobic exercise with 2 different intensity in this study reflects the probable effect of exercise on prostaglandin levels [2]. Though libido is shown to be decreased by physical exercise in several other studies [27]. The changes in estrogen and progesterone levels in late luteal phase leading to insomnia will be compensated by exercise [28].

Stress is stored in form of muscle tension which is the result of sympathetic abnormal activity. Cramp is caused by sympathetic nervous system which affects on uterine smooth muscles. Vascular contraction, resulted from stress, leads to hypoxy of uterine muscles. This hypoxy per se makes pain. All of these issues bring about from increase in sympathetic activity resulted from environmental stress. Physical activities are able to improve these problems [22]. Current research findings are in accordance with the results of Agarval *et al*. [25]. Axis of the hypothalamus - pituitary - adrenal (HPA) is part of neuroendocrine system and regulate many body functions such as appetite, immune system, mood, emotion, sexuality and save energy and reduce stress [29, 30]. Roca CA, *et al*. (2003) showed in their study that patients with PMS, respond of HPA axis during the luteal phase reduced and caused emotional and physical symptoms [31]. In a study by Watts JF, *et al*. conducted women with daily stress and symptoms of PMS had a higher level of cortisol and the more severe PMS symptoms and were experienced more frequently [32]. Physical activity through effects on the HPA axis reduces cortisol levels and improvements in psychological and behavioral responses to stress [33, 22]. In Kroll`s study [6], physical activity contributed to increased appetite, irritability, irritability, amnesia and decreased headache. Duster PA, *et al*(1999)suggested that the prevalence of PMS in athlete women is more than inactive women [5]. Rasheed P, Al-Sowielem LS.(2003) demonstrated that active women have higher PMS scores than inactive women [21].

The present study, also, showed that regular aerobic physical activities, with moderate and high intensities, decrease edema symptoms (swelling of breasts, bloating and overweight) in PMS. Prior JC, *et al*. (1991) have

shown that 6 months of regular aerobic exercise results in decrease of water retention (puffiness) and breast tenderness [17]. Edema symptoms in PMS are suggested to be related to increased serum levels of aldosterone and prostaglandin E2 and deficiencies of vitamin B6 and magnesium [28]. The reasons for increased serum aldosterone levels in late luteal phase are increased activity of rennin-angiotensin and decreased levels of progesterone and estrogen. Regular aerobic exercise is shown to decrease rennin and increase estrogen and progesterone levels leading to decreased serum level of aldosterone and improvement of edema symptoms [2, 7]. Increased level of prolactin in luteal phase is another cause of breast swelling and edema. Regular aerobic exercise in non-athlete women reduces serum prolactin level and causes symptoms recovery [28]. However, Aganoff JA, Boyle GJ. (1994) state that regular aerobic exercises are ineffective in water retention [14].

In the present study, no difference was observed between regular aerobic physical activity with high intensity (about 80 to 85% heart rate maximum) and regular aerobic exercise with moderate intensity (about 60 to 65% maximum heart rate) in reducing or improving symptoms of PMS. Stoddard *et al*. [23] and Scully D, *et al*. (1998) expressed that physical exercises with moderate intensity have more effectiveness in improving PMS symptoms [16].

Another finding showed that there is no correlation between BMI and PMS symptoms. While Masho SW, *et al*. (2005) examined relation between obesity and PMS symptoms and observed that obese women experience harsher symptoms of PMS and with physical activity and losing weight, the presence of symptoms would be reduced in them [34]. Regular aerobic exercise, by reducing fat tissue and subsequent reduction of estrogen and increase of progesterone, improve negative mood symptoms [26]. In contrast, Roca CA, *et al*. (2003) stated that aerobic training does not increase progesterone [30].

CONCLUSION

As a final result, this study showed that three months of regular aerobic exercise with high (about 80 to 85% heart rate maximum) and moderate (about 60 to 65% maximum heart rate) intensities, compared to the control group, reduced and improved PMS symptoms (negative mood, discomfort and edema); moreover, intensity of physical activity has no effect on the level of improvement or relief of symptoms. Also, in this study, no relation was observed between BMI and PMS symptoms.

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