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STUDY OF THE EFFECTS OF 8 WEEKS OF REGULAR AEROBIC EXERCISE ON THE INTENSITY OF PREMENSTRUAL SYNDROME SYMPTOMS

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ABSTRACT

Background and objective: Premenstrual syndrome is one of the psychosomatic problems related to reproductive performance and it is also related to emotional and mood disorders such as nervousness, anxiety and irritability and exercise can improve these symptoms. Therefore, we conducted this study to determine the impact of an 8-week regular aerobic exercise program on the severity of premenstrual syndrome symptoms.

Methodology of the research: We conducted this clinical trial study on 65 students in dormitories of Mashhad University of Medical Sciences based on a control group and an intervention group. We used the simple random sampling method. The intervention group engaged in 8 weeks of aerobic exercises, three times a week, and 20 minutes for each session. The tools were research unit selection questionnaire, midwifery and personal particulars, temporary determination of premenstrual syndrome, Beck Depression Inventory, recorded daily symptoms of premenstrual syndrome and Borg scale. We analysed the data using SPSS software and Mann–Whitney U test and Friedman test.

Results: In the beginning of the study, there was no significant difference between the two groups in terms of mean physical ($p = 0.56$) and psychological ($p = 0.06$) symptoms. In the beginning of the study, the two groups were homogeneous in terms of age, diet, academic level, and the features related to menstrual cycles. The results of this study showed that after an 8-week aerobic exercise, the physical symptoms of premenstrual syndrome in the intervention group ($p = 0.001$) and psychological symptoms in the intervention group ($p = 0.001$) had a significant reduction, but there was no significant change in the control group.

Conclusion: An 8-week regular aerobic exercise reduces the physical and psychological symptoms of premenstrual syndrome.

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Introduction

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In recent years, providing health has been considered a priority of women's rights [1]. Premenstrual syndrome is one of the psychosomatic problems related to reproductive performance and also emotional and mood disorders such as nervousness, anxiety and irritability [2]. This syndrome starts 6-12 days before the start of monthly bleeding and lasts for 2 days (max. 4 days) after the bleeding [3]. For the first time, Hippocrates pointed out the relationship between the menstrual cycle and menstrual changes. He discussed a feeling of heaviness and headache before menstruation with the assumptions that the symptoms were caused by turbulent blood seeking a way to exit [4].

Due to diversity, even estimating the severity of symptoms of this syndrome is a difficult task [5].

Premenstrual syndrome symptoms are divided into two categories of psychological and physical groups [6, 7]. Most women experience at least one of the symptoms of this syndrome in premenstrual period[8]. In some individuals the severity of these symptoms is to such extent that it causes emotional, behavioral and physical disorders especially in the field of family relationships and social and academic activities [1]. Some of the psychological symptoms include anxiety, irritability, depression, loss of control, drowsiness, insomnia or sleepiness, nervousness, aggressiveness, tendency to suicide, jumpiness, restlessness, confusion, social phobia; and some of physical symptoms are breast tenderness and swelling, edema in extremities, weight gain, headache, fatigue, skin rashes, joint pain, flatulence, changes in appetite and thirst [9-11].

Generally, premenstrual syndrome in many women leads to the reduction of social relationships and creates a negative attitude towards femininity and menstruation [12] , also in the affected population, alcohol and drug consumption and weakness in performing tasks increases [6]. In the meantime, approximately 30-40% of women need medical treatment and 5% suffer from severe cases of this syndrome [2].

Numerous factors make women vulnerable to premenstrual syndrome [13]. However, the real cause of premenstrual syndrome is almost unknown [14], but the researchers have mentioned different causes as predisposing factors of this syndrome such as age, smoking, alcohol and caffeine consumption, diet, taking oral pills before pregnancy, menstrual and reproductive history, exercise habits, sexual abuse background, history of premenstrual syndrome, marital status, pregnancy history, career, education level, genetics, social and cultural factors and the existence of psychological pressures [1].

Some recommended treatments to reduce premenstrual syndrome symptoms include pharmaceutical treatment such as: GnRh analogues, analgesics like mefenamic acid, antidepressant drugs including serotonin reuptake inhibitor, progesterone, using vitamin and mineral supplements, herbal medicine, including valerian, surgical therapy (removal of ovaries) and non-pharmaceutical treatments including massage, yoga, exercise and lifestyle modification [15-17].

With regard to the side effects of surgical and pharmaceutical treatments, they are used only in severe cases or cases where the patient is not responsive to other treatments. Hence, researchers who investigate the afflicted women have become more interested in non-pharmaceutical treatment and physical exercise[18]. The relationship between exercise and menstrual cycle and reproductive system changes was raised for the first time in the late 1930’s and the potential effects of exercise in the treatment of menstrual disorders such as dysmenorrhea, premenstrual syndrome, menopause and osteoporosis were suggested in the late 1980’s [19].

An active lifestyle promotes health and well-being. Since 19th century, health professionals and experts have deemed physical exercise and activity a necessity for women [20, 21]. Mild exercise balances body activities and reduces the intensity of the pressures which often cause problems before menstruation. Women who have more physical activity often complain less about premenstrual syndrome symptoms [18]. It seems that aerobic exercise increases the level of endorphins in circulation for a short time and has a non-specific analgesic action. It can also reduce depression symptoms and psychological problems [22].

Some researchers argue that conducting exercise activities with a frequency of over 4 times a week should reduce tension, depression and nervousness [16], while Kokril in 1995 concluded that exercise activities more than 4 times a week actually increase stress and nervousness and depression and if exercise is limited to 3 times a week it will have a more positive effect on the mental state [18].

Samadi et al. in a study of the impact of the regular 8-week aerobic exercise on the severity of the symptoms of premenstrual syndrome reported that exercise reduced the symptoms[23].

The clinical trial study by Fatoukian et al. in the year 2005 on 80 female nursing students also confirmed that an 8-week aerobic exercise program reduces the severity of the premenstrual syndrome symptoms [10].

However, in 1995 Barnhat stated that although aerobic exercise has a positive effect on the general health of the people but it has no specific impact on the premenstrual syndrome symptoms [3]. A study by SehatiShafai et al. in the year 2007 on 160 athlete and non - athlete students in the University of Tabriz showed that there is no difference between the two groups of athletes and non-athletes in terms of incidence of premenstrual syndrome [24]. A study by Dehghan Monshadi et al. in the year 2005 on 91 individuals confirmed that while the symptoms decreased in all groups but this decrease was not significant and only dermal symptoms, electrolyte and neurovegetative symptoms showed a significant reduction [25]. A study by Lustic in the year 2004 showed a nonlinear relationship between exercise with premenstrual syndrome symptoms, i.e. in the women who exercised intermittently, stress was more than the women who exercised more often or even did not exercise at all, in fact, this study stressed the importance of having a regular exercise program to reduce premenstrual syndrome symptoms [26].

Given that there are conflicting results about the relationship between exercise and premenstrual syndrome, the researcher decided to study the impact of a regular 8-week aerobic exercise program on the severity of the premenstrual syndrome symptoms.

Methodology of research

We conducted this clinical trial study with the registration code IRCT2015021721116N1 for 4 months on the dorm students of Mashhad University of Medical Sciences in the academic year 2014-15. A statistics consultant estimated the sample size as 35 individuals in each group according to Azhari et al. study and by taking into account $\alpha = 0.05$ and $\beta = 0.2$ with the inclusion of sample loss. The sampling was based on simple random sampling method and the individuals were assigned even and odd numbers and thus, were divided into two groups.

The requirements to be included in the study were as such: the individual must be a student and a resident of dormitory with 20-40 years of age, 21-35 days regular cycles with a 10-3 days period of bleeding, with premenstrual syndrome according to two standard questionnaires of temporary determination of premenstrual syndrome and recorded daily symptoms of premenstrual syndrome, the individual must not be pregnant, without chronic (renal, respiratory, cardiac, diabetes, hypertension, asthma, headache, migraine, thyroid, anemia, neuro-psychological) disease, not engaged in physical exercise courses or other sports programs, and no continuous use of medication (antihypertensive, antidepressant, antihistamine, anticholinergic, hormonal drugs), no stressful and unpleasant incident during the past 3 months,; and the criteria to exclude from the study included: unwillingness to continue the research, pregnancy during the study, irregular menstrual cycles during two months, failing to fill the questionnaire of recorded daily symptoms of premenstrual syndrome (3 consecutive days and 5 intermittent days), failure to do the exercises for 3 consecutive sessions or 4 intermittent sessions, and occurrence of bad and stressful incident during the study. The tools that we used included the questionnaire for overall profile of the participants and personal and midwifery particulars (we compiled the questionnaire with regard to the objectives of the research and study of the latest related resources and articles and after consultation with supervisors and advisers) and included 19 questions, 6 questions about personal particulars, 10 questions about midwifery and menstrual particulars, and 3 questions about the daily diet. This questionnaire included variables whose impact were measured in this research.

We used the content and formal credibility method to determine the validity of the questionnaire to select the research units, and the personal and midwifery particulars such that the questionnaires were presented to 10 members of the Midwifery Faculty in Mashhad University of Medical Sciences and all 10 members announced their corrective feedback. Some of the modifications were adding two questions to the research unit selection form and adding three questions related to diet to personal and midwifery particulars section.

Because in the present study the questionnaire of the checklist of research unit selection and general particulars and midwifery and personal particulars were objective and their reliability had been repeatedly determined in numerous studies, so there was no need to check the reliability of the questionnaire again).

The questionnaires of temporary determination of premenstrual syndrome (set temporary premenstrual syndrome) (the validity of this questionnaire was confirmed in 2013 by Shakeri et al.)[3] We measured the reliability of this questionnaire according to the re-test method and the Spearman–Brown correlation coefficient as 0.79).

Beck Depression Inventory- (This questionnaire with regard to the study by Jafarnejad et al. is a valid and reliable tool. A study by Jafarnejad et al. has mentioned that Beck et al. in 1996 obtained the credibility coefficient of the test, re-test, in a weekly interval as 0.93. A study by Ahmadi Tahoor in 2009 confirmed its content validity [3].

Recorded daily symptoms of premenstrual syndrome-(The validity of this questionnaire was confirmed in 2013 by jafarnejad et al.) [3]. The reliability of this questionnaire was by Cronbach's alpha Internal consistency, and the reliability coefficient was calculated as 0.77).

Borg scale-(It has the sufficient validity. Moreover, the validity of this questionnaire was confirmed by Azhary et al. in 2004. The reliability of the questionnaire was confirmed) [4].

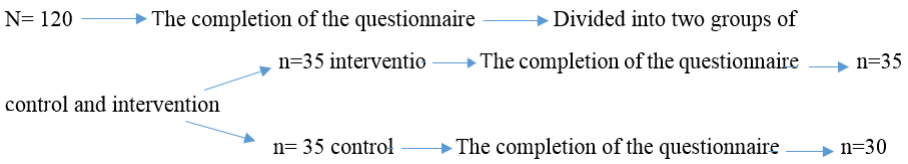
We conducted this study in two stages, a stage prior to intervention (2 months) and the next stage after the intervention (2 months).

In the first stage, the informed consent form and research unit selection form (including entry and exit criteria for the study) were submitted to 120 volunteers and they were completed in the presence of the researcher. Next, the volunteers who were qualified to be included in the research were identified, and in the second stage, in the timeframe of the first 7 days after menstruation, the researcher visited the research units and submitted the Beck depression questionnaire and the temporary determination of premenstrual syndrome questionnaire to be filled in the presence of the researcher. Upon completion of the questionnaires, the individuals who scored below 40% in depression questionnaire (the questionnaire included 21 phrases that were rated according to Likert scale and the overall score was 0 to 63) and had experienced 5 symptoms out of 11 symptoms of temporary determination of premenstrual syndrome questionnaire and one of those symptoms was among the first 4 symptoms of the questionnaire were selected as research units. In the third stage, the research units were obligated to prospectively record the daily intensity of their symptoms for 2 consecutive cycles in the daily recording form (including physical and psychological symptoms of premenstrual syndrome). During this time, the researcher made phone calls twice a week to remind the research units to regularly fill the forms and encouraged them to complete the form. There was no intervention during those 2 months and all individuals were asked to refrain from participating in any sport activities, otherwise they had to inform the researcher. At the end of the two months, the questionnaires were collected and the individuals who had the syndrome were pinpointed. People with mild severity (0-29%) or very intense severity (60% and above) of

premenstrual syndrome were excluded from the study (those with too low or too high intensity were excluded from the study due to generating false positive or negative results). In the fourth stage, the people were divided into 2 groups of intervention and control. At first, the researcher conducted the Queen College step test on both groups of intervention and control. In the fifth stage, in a face-to-face session, the research units of the intervention group learned the aerobic sport exercises. At the end of the session, the research units of the intervention group received educational posters and CD containing all of the learned movements. They were asked to do the aerobic exercises for 8 weeks, 3 times a week and 30 minutes each time. Each exercise cession included warming up movements for the first 5 minutes (including head movements, stretching and rotation of the shoulders and maintaining balance), cooling down for the last 5 minutes (movements in sitting and lying-down position to return to the initial state) and in the time between the two, aerobic exercises (kinetic movements including rotating and stretching the arms, rotating the upper body, standing-in-place movements). The research units, at the end of each exercise session, had to check their pulse rate and record it in the Borg questionnaire. Also, they were asked to record the intensity of the exercises according to the Borg scale. Moreover, during the 8-week period, the recorded daily symptoms questionnaire was routinely completed by research units. Twice a week, the researcher made phone calls to the research units and encouraged them to do the exercises and complete the questionnaires. Once every two weeks, the researcher visited the volunteers to check the situation of exercise activities in the intervention group by recording their pulse rates after exercise and the Borg scale performance, i.e. after exercise the heart rate should be in the range of 120-150 and the Borg scale in the range of 12-15.
The control group during the same 8-week period recorded their daily activities without having any exercise programs and were encouraged to complete the questionnaire on a regular basis twice per week through phone calls made by the researcher. Sixth stage. After the end of the 8-week period, after collecting the questionnaires from the two intervention and control groups, for the second time the Queen College step test was conducted and VO2max was calculated and compared with the prior results to check the effect of the performed exercises. At the end of the study, only 65 research units (35 in the intervention group and 30 in the control group) submitted the filled questionnaires. In the end, the obtained data were coded and then analyzed by SPSS22 software, descriptive statistical tests, and Friedman test.

Findings

At the beginning of the study, 70 individuals entered the study and 65 followed through to the end of the study and 5 individuals were excluded from the study due to their conditions that required so.



First, to check the homogeneity of the two intervention and control groups in terms of age, marital status, medical treatment history, medical treatment type, effectiveness of medical treatment, duration of bleeding, menstruation intervals, dysmenorrhea pain intensity, diet, puberty age and a history of syndrome in first-degree relatives (mother, sister), we conducted statistical tests and both groups were homogeneous **(Table 1).**

Table 1: check the homogeneity of the two intervention and control groups

Characteristic of the demographic	Intervention	control	P Value
age	0/28	0/98	0/2
Marital status	0/69	0/87	0/13
The history of absence from work	0/73	0/41	0/50
The history of the use of the therapeu-tic measures used before study	0/6	0/11	0/30
The history of the type of treatment used prior to the study	0/21	0/23	0/50
A history of the impact of the treatment used prior to the study	0/59	0/17	0/40
Menstrual intervals	0/54	0/95	0/40
monthly bleeding	0/51	0/59	0/37

The severity of Dysmenorrhea pain	0/8	0/59	0/70
The diet used	0/008	1/00	0/70
Depression score	0/24	0/32	0/19

We conducted statistical analysis and reviews on the premenstrual syndrome symptoms in accordance with the special objectives:

-The results of the Friedman test showed physical symptoms of syndrome were significantly reduced in the intervention group 8 weeks after aerobic exercises compared with the control group (p = 0.001). **(Table 2)**

-The results of the Friedman test showed that psychological symptoms of premenstrual syndrome were significantly reduced in the intervention group 8 weeks after aerobic exercises compared with the control group (p = 0.001). (**Table 3)**

Table 2: Mean physical symptoms of premenstrual syndrome symptoms in the control and intervention groups during the 16 weeks of the study

Group / **Months of study**	**Intervention SD ± mean**	**Control SD ± mean**	**P value Mann–Whitney**
First Month before intervention	21.34±3.28	21.60±3.42	0.56
Second Month before intervention	20.68±3.75	21.70±3.40	0.2
4 weeks after intervention	10.34±1.66	21.76±3.31	0.001
8 weeks after intervention	10.00±2.5	21.26±3.12	0.001
P value Friedman	0.001	0.08	

Table 3: Mean psychological signs of premenstrual syndrome symptoms in the control and intervention groups during the 16 weeks of the study

Group / **Months of study**	**Intervention SD ± mean**	**Control SD ± mean**	**P value Mann–Whitney**
First Month before intervention	12.17±1.63	11.80±2.18	0.06
Second Month before intervention	11.82±1.94	11.26±2.25	0.3
4 weeks after intervention	5.77±0.87	11.13±2.59	0.001
8 weeks after intervention	5.57±1.37	10.56±2.42	0.001
P value Friedman	0.001	0.3	

Discussion

The results of this study showed that performing aerobic exercises in the intervention group reduced the physical symptoms of premenstrual syndrome (p = 0.001). Azhari *et al.* (2005) in their study concluded that regular aerobic exercise for 8 weeks significantly reduced the physical and psychological symptoms of premenstrual syndrome (p = 0.001)[4]. Samadi *et al.* (2013) in a study entitled *The Effect of 8 Weeks of Aerobic Exercise on the Premenstrual Syndrome Symptoms*, reported that physical

and psychological symptoms of premenstrual syndrome (p = 0.001) were significantly reduced[23]. Mossalanejad *et al*. (2006) also studied the effects of physical exercise on the premenstrual syndrome in girls and concluded that the physical (p = 0.005) and psychological (p = 0.008) symptoms of premenstrual syndrome improved after aerobic exercises [27]. Gomes (2002) also checked the two groups of athletes and non-athletes and reported significant reduction of physical and psychological symptoms of premenstrual syndrome (p<0.05) after sport activity [28]. Smith *et al* (1998) mentioned the positive effects of sport activities on the physical symptoms of premenstrual syndrome while did not report a significant impact on the psychological symptoms[29]. Kariman *et al.* (2005) also reported that exercise reduced physical and psychological symptoms of premenstrual syndrome (p = 0.001)[21]. Dehghan Monshadi *et al.* (2006) mentioned the impact of exercise on electrolyte symptoms (swelling, breast pain, headache) (p=0.05) and neurovegetative (sleep disorder and anorexia) (p=0.003) and psychological symptoms (p=0.02) [25]. Steege et al. in 1993 in a study titled *The Effects of Exercises Activities on the Premenstrual Syndrome Symptoms in Middle-aged Women* reported that physical and psychological symptoms in aerobic exercise group (p<0.05) were significantly reduced but in anaerobic exercise group (p>0.05) symptoms were reduced, however, this decrease was not significant [15].

Yekke Fallah *et al.* concluded that a 3-month aerobic exercise and walking only at the end of the first month (p=0.001) reduced the physical premenstrual syndrome symptoms and there was not any significant change at the end of the third month (p = 0.11), also there was not any significant change in the psychological symptoms[20]. Prior reported in 1996 that in women who engaged in running exercises for three months, the sum total scores of physical symptoms of premenstrual syndrome (p>0.05) did not show a significant change before menstruation[30]. Imami *et al.* also reported that after a 3-month period of exercise, there will be no significant change in the psychological symptoms (p>0.05) of premenstrual syndrome [31]. The study by Moqaddasi *et al*. also showed that psychological symptoms of premenstrual syndrome in athletes showed no significant changes compared to the non-athletes [32]. Smith also stated that regular exercises did not improve the psychological and spiritual symptoms caused by premenstrual syndrome[18].

Keye reported in his research that the anxiety in people who exercise regularly is lower than people who exercise irregularly [3]. Grilin *et al*. (1998) investigated the impact of a six-month exercise program on premenstrual syndrome symptoms and concluded that among the symptoms, anxiety improves with exercise [21].

In fact, it can be said with regard to these signs that based on the lower levels of beta-Endorphin in the late luteal phase due to sex hormone changes, aerobic exercise by increasing the level of beta-Endorphin and an effect on the brain neurotransmitters improves these symptoms [33]. It is also proven that exercise reduces depression and anxiety and relieves stress and mental pressures and even may cause changes in the character like the emergence of better outlook towards life. Aerobic exercises are very effective in the treatment of depression and anxiety [34]. The positive effects of aerobic exercise on psychological and emotional symptoms of premenstrual syndrome can be explained from another perspective. Based on cognitive-behavioral theory, cognitive disorders and annoying thoughts lead to depression, so exercise by removing negative thoughts and giving rise to positive thoughts in the short term can reduce depression. Aganoffy (1994) explained the effect of aerobic exercise in reducing negative mental states such as anger, feeing of guilt, and hate[26].

In fact, another mechanism of exercise impact is on the blood leptin levels in women afflicted with premenstrual syndrome. Leptin is a hormone secreted from the fat cells which regulates the metabolism of hypothalamic-pituitary-gonadal axis and has a major role in human reproduction. The neuroendocrinology and metabolic effects of this hormone are due to its receptors in the hypothalamus, i.e. where the emotional perception is controlled. Therefore, it can be said that the positive impact of exercise on premenstrual syndrome symptoms may be explained due to this mechanism. The results of a research also demonstrated that the concentration of leptin in the blood circulation of women with premenstrual syndrome is significantly higher than women without premenstrual syndrome and a high amount of this hormone may have a relationship with psychological symptoms of premenstrual syndrome [26,35].

But given that there are conflicting results about the impact of exercise on premenstrual syndrome symptoms, perhaps exercise *per se* can reduce the symptoms of premenstrual syndrome, but different results could be due to other factors influencing the premenstrual syndrome that were not examined in this research and other researches and thus, we recommend that the future research shall be conducted by controlling all influencing factors on the syndrome and with a higher sample size.

Conclusion

The results of this study showed that regular aerobic exercise for 8 weeks reduced the physical and psychological symptoms of premenstrual syndrome.

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