http://www.cjmb.org

Open Access Original Article

Crescent Journal of Medical and Biological Sciences
Vol. 2, No. 2, Spring 2015, 53-58

eISSN: 2148-9696

The Association between Premenstrual Syndrome and Physical Activity and Aerobic Power in Female High School Students

Yekta Sabaei[1], Sara Sabaei[2], Davood Khorshidi[3], Soheil Ebrahimpour[4], Fatemeh Fallah-Rostami*[5]

Abstract

Objective: The purpose of this study was to investigate the relationship between premenstrual syndrome (PMS) and physical activity, aerobic power, and anaerobic power in female high school students.

Materials and Methods: A total of 367 female high school students were selected randomly from district 5 of Tehran. Among them, 40 students who had the highest PMS score and all the inclusion criteria of the study were selected as subjects. The level of physical activity was assessed using the Baecke Physical Activity Questionnaire and PMS was assessed using a self-report questionnaire. Aerobic power was assessed using submaximal 1-mile track jog test. Pearson's correlation coefficient was used for analyzing the relationship between variables.

Results: The results indicated a significant negative correlation between PMS and physical activity ($r = -0.86$ and $P < 0.05$) and aerobic power ($r = -0.71$ and $P < 0.05$).

Conclusion: Based on the findings, it seems that regular physical activity, especially aerobic activities, can be effective in reducing the symptoms of PMS.

Keywords: Exercise Test, Physical Activity, Premenstrual Syndrome (PMS)

Introduction

Menstrual disorders are very common in teenagers and young women. These disorders are often a source of anxiety for patients and their families. Common disorders in adolescents include amenorrhea, abnormal and excessive bleeding, and premenstrual syndrome (PMS) (1,2). PMS is common among women in their reproductive age. This syndrome causes a set of distressing physical, mental, and behavioral changes which recurs during the luteal phase of the menstrual cycle. About 75 to 90% of women experience it before their menstrual period (2). In addition, 20 to 40% of cases of this complication occur in the age range of 25 to 35 years (3,4). The recurrence of symptoms for at least two consecutive cycles is the diagnosis criteria of the syndrome. Women may, at any time during their fertility years, experience PMS, which is sometimes mild and sometimes severe. During menstruation, over 20% of women experience PMS to a degree that they require clinical treatment (5). PMS symptoms can be divided into two categories of physical changes (including headaches, muscle aches, fatigue, weight-gain, and breast pain), and psychological symptoms and mood disorders (including depression, anger, anxiety, crying for no reason, and impaired daily functioning). In various studies, more than 150 symptoms have been associated with this syndrome (5,6). Several studies have suggested the effects of PMS on daily life and social and work

Received: 19 Dec 2014, **Revised**: 22 Jan 2015 **Accepted:** 13 Feb 2015, **Available online:** 15 Apr 2015

[1] Karaj Branch, Islamic Azad University, Karaj, Iran
[2] Science and Research Branch, Islamic Azad University of Rasht, Rasht, Iran
[3] Department of Physical Education and Sport Sciences, Saveh Branch, Islamic Azad University, Saveh, Iran
[4] Infectious Diseases and Tropical Medicine Research Center, Babol University of Medical Sciences, Babol, Iran
[5] Ministry of Health and Medical Education, Psychiatry and Behavioral Sciences Research Center, Mazandaran University of Medical Sciences, Sari, Iran
*Corresponding Author: Fatemeh Fallah-Rostami, Ministry of Health and Medical Education, Psychiatry and Behavioral Sciences Research Center, Mazandaran University of Medical Sciences, Sari, Iran
Tel: +98 2181454315, Email: fallah.rostami@yahoo.com

activities of different groups of women (7). In researches conducted in America, these disorders were reported to be common, although exact figures were not mentioned (8). In a study conducted on Swedish women, the mild form of this syndrome was reported in 72% of the cases (6). In Iran, an extensive study has not been conducted on the general population of women. However, Allahverdipour et al. have reported the prevalence of this disorder among high school girls as 40% (9). According to a study conducted in 2004, women with PMS, compared to women without this syndrome, had more absent days from work and more days on which they had trouble with their homework and work (10). The cause of PMS is still not fully understood. However, several factors such as fluctuations in estrogen and progesterone levels, neuroendocrine disorders, diversity of estrogen receptors, and synthesis of prostaglandins, and environmental factors such as alcohol and stress have been proposed. The risk factors of being single, poor education, lack of mobility and exercise, smoking, and consumption of sugary food and beverages with caffeine were also associated with this syndrome.

In addition to the controversy regarding the cause of the symptoms of PMS, there are also disagreements among doctors regarding its treatments. More than 300 different treatments have been suggested to relieve symptoms of PMS (11). There is no single treatment that is universally accepted in relation to PMS. Different therapeutic interventions, such as lifestyle changes, stress management training (massage and reflexology therapy), yoga, exercise, vitamins, herbal remedies, selective serotonin reuptake inhibitors, and antidepressants, exist (1). According to Dickerson et al., treatment of PMS symptoms is based on improving or eliminating its symptoms, reducing its impact on activities and interpersonal communication, and minimizing the side effects of the treatment (12). Initially, all patients will be followed up by non-pharmacologic therapies. Drug therapies should be used for patients in whom, despite the non-pharmacologic therapies, symptoms persist. PMS symptoms treatment is aimed at restoring appropriate body function and it often requires a combination of lifestyle modification and drug therapy (11).

A number of researchers believe that increase in aerobic exercise for 20 to 30 minutes 3 times per week, and exercises such as stress reduction techniques can improve PMS symptoms. Normally, the body uses phosphagens to provide energy in activities lasting up to 15 seconds, glycolytic in any activity that lasts between 1 to 3 minutes, and oxygen (aerobic) in activities that last more than 5 minutes. The body uses aerobic metabolism to supply energy in activities that last more than a few minutes. Aerobic activities lead to long-term maintenance of a healthy cardiovascular system. Investigation showed that regular exercise results in changes in this syndrome. Exercise reduces PMS symptoms in athletic women. Although the effects of exercise on the treatment of PMS symptoms have not been directly studied, evidence suggests that it can be helpful in reducing symptoms (13). Some studies suggest an inverse relationship between PMS and exercise (14). The results of another study showed that people performing moderate exercise are protected from this syndrome and others have found no relationship between exercise and PMS symptoms (15). Given that exercise, compared with medical therapy, has no side effects and risks, including it in daily activities is more appropriate. Stoddard et al. have shown that athletes have a higher aerobic capacity and significantly lower syndrome scores (16). It was shown that aerobic exercise in patients with PMS reduces the severity of the syndrome and improves their work and social performance. Most studies have been conducted on endurance and aerobic activities regarding the relationship between PMS and sports activities. However, some studies have shown that aerobic exercises such as walking and swimming, compared with non-aerobic exercises and strength training, have greater impact on the reduction of psychiatric symptoms of this syndrome including depression (17-19). The study by Giacomoni et al., entitled Influence of the menstrual cycle phase and menstrual symptoms on maximal anaerobic performance, showed that having menstrual problems including PMS reduces maximal aerobic power (20).

PMS has a high prevalence, has adverse effects on students' academic performance, and limits the academic and economic progression of this group of society. Therefore, this study aimed to investigate the relationship of physical activity, aerobic capacity, and anaerobic power with the prevalence of PMS among students. It is hoped that the results of this study will be a positive step toward relieving PMS symptoms and providing favorable physical and mental conditions for students' achievements.

Materials and Methods

This study was a descriptive correlational study. The study population included female students in first, second, and third grades of district 5 of the Education Ministry of Tehran, Iran, in the academic years of 2013-2014. The initial sample was selected based on Morgan's table and 367 students were determined as research prototype volunteers. For this purpose, after gaining permission from the Education Ministry of district 5 of Tehran, 4 schools were randomly selected from the Northern, Southern, Eastern, and Western regions of district 5 of the Education Ministry of Tehran. Then, by referring to these schools and coordinating with school administrators, demographic and PMS questionnaires were distributed. Before presenting the questionnaires to the students, the objectives, requirements, procedures, timing of research, and also how to complete the questionnaires were explained to them.

Inclusion criteria included being within the age range of 15 to 17 years, being single, having regular

menstruation, incidence of different severity of PMS symptoms as registered, non-smoking, and lack of use of drugs and birth control pills, any special diet, any special surgery for women, a history of ovarian cysts, and non-specific mental and physical illnesses. After collection of the questionnaires and assessment of the scores, 40 participants who had the highest scores on the PMS questionnaire and met all the inclusion criteria were selected as final subjects. Table 1 illustrates the mean of age, height, weight, BMI, body fat percentage, PMS score, aerobic power, and anaerobic power of the subjects.

Table 1. Variables and average deviation (n = 40)

Variable	Mean ± SD
Age (year)	15.60 ± 0.77
Height (cm)	156.70 ± 26.20
Weight (kg)	60.30 ± 11.20
BMI (Kg/Square of meters)	23.60 ± 4.05
Body fat (%)	9.60 ± 4.35
Premenstrual syndrome	41.70 ± 6.30
Physical activity	4.70 ± 1.20
Anaerobic power (kgmeters/s)	1.11 ± 3.46
Aerobic power (ml/kg/min)	1.30 ± 2.44

BMI: Body mass index

The subjects were first introduced to the aerobic and anaerobic power assessment and evaluation of anthropometric indicators. Then, they were asked to complete the written informed consent form for voluntarily participation in the study. To assess PMS, a self-report questionnaire was used. This questionnaire consisted of 10 items scored on a 6-point scale, where 1 represented the absence of symptoms, and other numbers, respectively, indicated low levels, mild, moderate, severe, and extremely severe. The total score of the questionnaire ranged from 10 to 60. A total score of 30 indicates mild PMS and scores higher than 30 indicate more severe symptoms, which reduce the performance of the individual. The validity of this questionnaire was confirmed in 2003 by Halbreich (21), and in Iran, its validity and reliability was confirmed by Azhary et al. (22). Anthropometric measures were determined using a body composition device (Biospace, Korea). To assess physical activity, Baecke Physical Activity Questionnaire was used. The subjects were asked to answer the questions accurately and on time and to return them. Ultimately, 355 questionnaires that were fully answered were returned by the students. To assess aerobic capacity, a 1 mile submaximal test, in which the subjects were asked to steadily walk a mile (1609 meters) with maximum steps, was used. Thus, the subjects' heart rate would not exceed 180 beats per minute during the test and the test execution time would not be less than 9 minutes. To assess the anaerobic power of the subjects rest test was conducted. This test was invented and developed in 1997 at the University of Southampton, UK. This is a field test with 87% reliability and validity. This is how the test is conducted: the examinees walk back and forth 6 times with maximum speed a distance of 35 meters on a flat and hard surface, between every 35 meters, 10 seconds of rest is considered.

Statistical analysis

Mean power is determined according to the time obtained from every 35 meters, the power of each iteration according to its special formula, and based on the total teva 6 repetitions. After obtaining the necessary information from the participants, inferential statistics (mean and standard deviation) was used. To determine the association between PMS, physical activity, aerobic power, and anaerobic power, the Pearson correlation coefficient was used. After coding the information, data were analyzed using SPSS software (version 16, SPSS Inc., Chicago, IL, USA). The criterion for decision-making to test the hypothesis was 0.05.

Results

The mean age of the participants was 15.6 ± 0.77 years. Mean score of PMS was 41.75. Mean height was 156.72 ± 26.2, mean weight was 60.33 ± 11.2, mean aerobic power was 44.20 ± 2.44 ml/kg/min, mean anaerobic power was 48.33 ± 3.46 W, and mean physical activity was 4.853 ± 1.2. Table 2 shows the correlation coefficients between the variables.

Based on the results of the correlation coefficient, there was a relationship between physical activity and PMS. The index value was -0.859, which was significant at 95% level. In other words, there was a relatively strong correlation between the two variables. Since this number was negative, there is an inverse relationship between the two variables, meaning that by an increase in aerobic fitness levels, PMS reduced and with a reduction in aerobic fitness, PMS increased. The correlation coefficient also showed a relationship between aerobic capacity and PMS. The value of this coefficient was -0.706 and was significant at the 95% level. In other words, there was a relatively strong negative correlation between the two variables. This means that an increase in

Table 2. Coefficient correlation between premenstrual syndrome (PMS) and other variables

Dependent variable Independent	Correlation coefficient	P
Physical activity	-0.859	0.001*
Aerobic power	-0.706	0.001*
Anaerobic power	0.024	0.884

* 95% confidence interval and P value of 0.05

aerobic capacity, the severity of PMS decreased and with a reduction in aerobic power, PMS increased. The results regarding the relationship between PMS and anaerobic power showed that the value of this coefficient was 0.024, which was not significant. In other words, a very weak correlation exists between these two variables and it is not significant.

Discussion

The findings of the present study regarding the correlation coefficient between physical activity and PMS showed that there was a relatively strong negative correlation between the two variables ($r = -0.859$; $P < 0.05$). This means that with an increase in physical activity, the severity of PMS decreased and with a reduction in aerobic fitness, PMS increased. Recently, in a study on the relationship between physical activity and PMS, it was demonstrated that this syndrome and physical activity levels of students have a significant negative correlation ($r = -0.506$; $P < 0.001$). Another study has shown a direct significant relationship between PMS and lack of physical activity ($P = 0.005$) (23). In addition, the study by Dishman, which examined the effects of regular physical activity and physical training on the symptoms of PMS, illustrated the effect of exercise on the reduction of the symptoms of PMS (24).

Lustyk et al., in a study on 114 women of 18-33 years of age, showed that PMS symptoms were more severe in individuals who often exercised than those who exercised regularly (25). In another study, it was shown that physical activity can reduce the symptoms of PMS and negative psychological states such as anger, hatred, sadness, and shame (26). Physical activity may also reduce the symptoms of PMS by biological mechanisms including increased levels of endorphins, impact on the level of the hypothalamic-pituitary-gonadal (HPG) axis hormones in the blood circulation, decreased levels of estrogen and progesterone, improved oxygen supply to the muscles, and improved mental and emotional states. Physical activity may also improve the immune system function, by increasing the body's resistance to stress (27). The effect of exercise on brain endorphins improves the mood symptoms. Stress, by reducing endorphins in the brain and increasing adrenal cortisol, can cause mood symptoms in individuals and for the treatment of PMS, stress preventive methods are necessary such as exercise (28). Another possible mechanism of the effect of exercise is on the blood leptin levels in women with PMS. Leptin is a hormone secreted by fat cells, regulates the metabolism of HPG axis, and has an important role in human reproduction. The neuroendocrinology and metabolic effects of this hormone are accomplished by its receptors in the hypothalamus, where the sense of emotion is controlled. A study by Freeman et al. has shown that circulating leptin concentrations in women with PMS is significantly higher than in women without PMS symptoms (29). High levels of this hormone may be related to the psychological symptoms of PMS. Studies have presented varying results with regard to the effects of exercise on blood leptin levels. The study by Kraemer et al. has shown that exercise can reduce the blood leptin by 30%, and others have shown that exercise can reduce the amount of leptin in the blood by 34% (30). Exercise, with the reduction of the amount of leptin in women, may reduce the mood symptoms of PMS. However, the results of other studies have indicated that exercise has no effect on leptin concentrations. Unlike the present study, some studies have not found a relationship between PMS and physical activity (31). Kritz-Silverstein et al., in a research on 18-49-year old women, did not find any relationship between the symptoms of PMS and physical activity (32). In another study, no relationship was observed between the incidence of PMS symptoms and physical activity in women of 18-30 years of age (33). In a study of the incidence of PMS, there was no significant difference between a group of athletes and a group of non-athletes (34). However, contrary to the findings of the present research and studies that illustrated the effectiveness of physical activity on reduction of PMS incidence, another study has reported the increased risk of PMS in active women compared to inactive women (35). The varying results of studies on the effectiveness of physical activity on PMS symptoms, in addition to methodological reasons, might be due to the fact that most of the women have reported that they feel better while relaxed and laid down during menstruation cramp pains and early days of the menstrual cycle, while some women feel less pain with physical activity. Perhaps the difference between these people can justify the reports. It seems that some of the differences were related to cultural differences, and negative views toward menstruation, and subsequently, restrictions on women's response to the menstrual cycle in different communities. Other causes of this discrepancy were the age of the subjects, and their lifestyles. For ages below 17 years, ovulation is still not completely stabilized, and thus, the possibility of this syndrome is different. Intensity and type of exercise also varies in different studies. The present study also showed that there was a negative significant correlation between the incidence of PMS and aerobic power in high school girls ($r = -0.706$; $P < 0.05$). In line with these findings, Berk et al. found an inverse relationship between aerobic capacity and PMS scores of 40 students (20 athletes and 20 non-athletes) with a mean age of 23 years (36). The results of this study also showed that PMS symptoms were less common in athletes than non-athletes. Another study showed that 3 months of aerobic exercise, 3 days a week and every day for 1 hour, was effective in reducing the

symptoms of PMS (37). The favorable effects of aerobic activity in reducing PMS symptoms have been reported in numerous studies. The study by Pearlstein and Steiner demonstrated the favorable effects of aerobic exercise on physical and emotional symptoms associated with PMS (38). Moreover, by examining the effects of aerobic activity on PMS symptoms, it was found that moderate-intensity (60 to 80% of maximum heart rate) and severe-intensity (80 to 90% of maximum heart rate) aerobic activity, compared to light aerobic activity (30 to 60% of maximum heart rate), significantly reduced the symptoms of this syndrome. Most researchers, who have supported the effect of exercise on the improvement of PMS, have insisted on aerobic exercise. This could be the reason for the lack of significant differences between athletes and non-athletes. The intensity of exercise may also not be enough for athletes to improve the symptoms of the syndrome, because athletes have a higher pain threshold.

Other findings of the present study showed that the correlation between anaerobic power and PMS was not statistically significant (r = 0.024). Most studies on the relationship between PMS and exercise have discussed endurance and aerobic activities. However, some studies have shown that aerobic exercise such as walking and swimming, compared with non-aerobic exercise and strength training, has a greater impact on psychological symptoms of this syndrome, especially depression. Giacomny et al., in their study entitled the effects of menstrual cycle and its symptoms on maximal anaerobic performance, concluded that although there were no significant differences in maximal anaerobic performance at different stages of the menstrual cycle, menstrual disorders affect the ligaments stretching system and tendons, and anaerobic performance (32). Given that there were very few researches and limited findings regarding the relationship between PMS and anaerobic power, a definitive statement about the relationship between aerobic fitness and symptoms of this syndrome requires more extensive research. In most of the existing researches on PMS, in the first phase of treatment, non-drug methods such as exercise and physical activity were recommended and if signs and symptoms of this syndrome persisted, medications or hormonal methods were proposed. There were limitations in this study regarding the number of participants who agreed to participate in the study. Moreover, measuring the stress and anxiety of the participants during the study was another limitation.

Conclusion

Taking into account the findings of the present study, it can be concluded that lifestyle modification with an emphasis on increasing physical activity, especially aerobic activities, can be effective in reducing PMS symptoms.

Ethical issues

Ethical of this research work was approved by Tehran University of Medical Sciences.

Conflict of interests

We declare that we have no conflict of interests.

Acknowledgments

This article was the result of an MA thesis in exercise physiology in Azad University of Karaj, Science and Research Branch, number 1521402912035. Our sincere appreciation goes to the high school girls of district 5 of Tehran who participated in this study, officials of the Education Ministry, and professors who helped us perform this research.

References

1. Hickey M, Balen A. Menstrual disorders in adolescence: investigation and management. Hum Reprod Update 2003; 9: 493-504.
2. Thakre SB, Thakre SS, Ughade S, Thakre AD. Urban-rural differences in menstrual problems and practices of girl students in Nagpur, India. Indian Pediatr 2012; 49: 733-6.
3. Richards M, Rubinow DR, Daly RC, Schmidt PJ. Premenstrual symptoms and perimenopausal depression. Am J Psychiatry 2006; 163: 133-7.
4. Redman LM, Loucks AB. Menstrual disorders in athletes. Sports Med 2005; 35: 747-55.
5. Epperson CN, Steiner M, Hartlage SA, Eriksson E, Schmidt PJ, Jones I, et al. Premenstrual dysphoric disorder: evidence for a new category for DSM-5. Am J Psychiatry 2012; 169: 465-75.
6. Kristjansdottir J, Olsson GI, Sundelin C, Naessen T. Self-reported health in adolescent girls varies according to the season and its relation to medication and hormonal contraception--a descriptive study. Eur J Contracept Reprod Health Care 2013; 18: 343-54.
7. Robinson RL, Swindle RW. Premenstrual symptom severity: impact on social functioning and treatment-seeking behaviors. J Womens Health Gend Based Med 2000; 9: 757-68.
8. Huntley A, Ernst E. A systematic review of the safety of black cohosh. Menopause 2003; 10: 58-64.
9. Allahverdipour H, Bazargan M, Farhadinasab A, Moeini B. Correlates of video games playing among adolescents in an Islamic country. BMC Public Health 2010; 10: 286.
10. Bloch M, Schmidt PJ, Danaceau M, Murphy J, Nieman L, Rubinow DR. Effects of gonadal steroids in women with a history of postpartum depression. Am J Psychiatry 2000; 157: 924-30.
11. Lopez LM, Kaptein AA, Helmerhorst FM. Oral contraceptives containing drospirenone for premenstrual syndrome. Cochrane Database Syst Rev 2012; 2: CD006586.
12. Dickerson LM, Mazyck PJ, Hunter MH.

Premenstrual syndrome. Am Fam Physician 2003; 67: 1743-52.
13. Rapkin AJ, Mikacich JA. Premenstrual dysphoric disorder and severe premenstrual syndrome in adolescents. Paediatr Drugs 2013; 15: 191-202.
14. Penedo FJ, Dahn JR. Exercise and well-being: a review of mental and physical health benefits associated with physical activity. Curr Opin Psychiatry 2005; 18: 189-93.
15. Salmon P. Effects of physical exercise on anxiety, depression, and sensitivity to stress: a unifying theory. Clin Psychol Rev 2001; 21: 33-61.
16. Stoddard JL, Dent CW, Shames L, Bernstein L. Exercise training effects on premenstrual distress and ovarian steroid hormones. Eur J Appl Physiol 2007; 99: 27-37.
17. Zaka M, Mahmood KT. Premenstrual syndrome-a review. J Pharm Sci Res 2012; 4: 1684-91.
18. Fallah-Rostami F, Gaeini AA, Alidoust-Gahfarokhi E, Samadani AA, Abouhosseini Tabari M, Ebrahimpour S. The influence of iron and lactate in sport women in depleted and not depleted body position. Ecology, Environment and Conservation Paper 2013; 19: 979-84.
19. Verma RK, Chellappan DK, Pandey AK. Review on treatment of premenstrual syndrome: from conventional to alternative approach. J Basic Clin Physiol Pharmacol 2014; 24: 319-27.
20. Giacomoni M, Bernard T, Gavarry O, Altare S, Falgairette G. Influence of the menstrual cycle phas.e and menstrual symptoms on maximal anaerobic performance. Med Sci Sports Exerc 2000; 32: 486-92.
21. Halbreich U, Borenstein J, Pearlstein T, S Kahn L. The prevalence, impairment, impact, and burden of premenstrual dysphoric disorder (PMS/PMDD).Psychoneuroendocrinology2003; 8: 1-23.
22. Azhary S, Karimi Chatrudi A, Attarzadeh R, Mazloom R. Officacy of group aerobic exercise program on the intensity of premenstrual syndrome. Iranian Journal of Obstetric, Gynecology andInfertility 2005; 8: 119-28.
23. Pinar G, Colak M, Oksuz E. Premenstrual Syndrome in Turkish college students and its effects on life quality. Sex Reprod Healthc 2011; 2: 21-7.
24. Dishman R. Physical activity and public health: mental health. Quest 1995; 47: 362-85.
25. Lustyk MK, Widman L, Paschane A, Ecker E. Stress, quality of life and physical activity in women with varying degrees of premenstrual symptomatology. Women Health 2004; 39: 35-44.
26. Ventegodt S, Morad M, Hyam E, Merrick J. Clinical holistic medicine: holistic sexology and treatment of vulvodynia through existential therapy and acceptance through touch. ScientificWorldJournal 2004; 4: 571-80.
27. Fernandez-Real JM, Pickup JC. Innate immunity, insulin resistance and type 2 diabetes. Diabetologia 2012; 55: 273-8.
28. Kollipaka R, Arounassalame B, Lakshminarayanan S. Does psychosocial stress influence menstrual abnormalities in medical students? J Obstet Gynaecol 2013; 33: 489-93.
29. Freeman EW, Sammel MD, Grisso JA, Battistini M, Garcia-Espagna B, Hollander L. Hot flashes in the late reproductive years: risk factors for Africa American and Caucasian women. J Womens Health Gend Based Med 2001; 10(1): 67-76.
30. Kraemer RR, Chu H, Castracane VD. Leptin and exercise. Exp Biol Med (Maywood) 2002; 227: 701-8.
31. Spiegel K, Leproult R, L'hermite-Baleriaux M, Copinschi G, Penev PD, Van CE. Leptin levels are dependent on sleep duration: relationships with sympathovagal balance, carbohydrate regulation, cortisol, and thyrotropin. J Clin Endocrinol Metab 2004; 89: 5762-71.
32. Kritz-Silverstein D, Wingard DL, Garland FC. The association of behavior and lifestyle factors with menstrual symptoms. J Womens Health Gend Based Med 1999; 8: 1185-93.
33. Ford ES. The epidemiology of obesity and asthma. J Allergy Clin Immunol 2005; 115: 897-909.
34. Cockerill IM, Nevill AM, Byrne NC. Mood, mileage and the menstrual cycle. Br J Sports Med 1992; 26: 145-50.
35. Lustyk MK, Jarrett ME, Bennett JC, Heitkemper MM. Does a physically active lifestyle improve symptoms in women with irritable bowel syndrome? Gastroenterol Nurs 2001; 24: 129-37.
36. Berk M, Sarris J, Coulson CE, Jacka FN. Lifestyle management of unipolar depression. Acta Psychiatr Scand Suppl 2013: 38-54
37. Fugh-Berman A, Kronenberg F. Complementary and alternative medicine (CAM) in reproductive-age women: a review of randomized controlled trials. Reprod Toxicol 2003; 17: 137-52.
38. Pearlstein T, Steiner M. Premenstrual Dysphoric Disorder: Burden of Illness and Treatment Update. Women's Mental Health 2012; 10: 90-101.

Citation: Sabaei Y, Sabaei S, Khorshidi D, Ebrahimpour S, Fallah-Rostami F. **The Relationship between Premenstrual Syndrome and Physical Activity and Aerobic Power in Female High School Students**. Crescent J Med & Biol Sci 2015; 2(2): 53-8.