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Does Aerobic Exercise Decrease Bloating Symptoms in Females with Pre-Menstrual Syndrome?

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ABSTRACT

OBJECTIVE: The objective of this selective EBM review is to determine whether aerobic exercise is effective at improving bloating symptoms in females with premenstrual syndrome.

STUDY DESIGN: A systematic review of two randomized controlled trials (RCTs) and one quasi-experimental trial (analyzed as a case series) published in English after 2010.

DATA SOURCES: All articles were obtained from peer reviewed databases and journals via PubMed, AMED, Cochrane Library.

OUTCOMES MEASURED: The outcome measured was reduction in bloating symptoms after an aerobic exercise regimen using the questionnaires of temporary determination of PMS for Dehnavi et al, premenstrual distress questionnaire and daily symptom report for Maged et al., and Menstrual Symptom Questionnaire for Vishnupriya and Rajarajeswarm.

RESULTS: In the RCT conducted by Dehnavi et al (*BMC Womens Health.* 2018: 18 (1):80.doi:10.1186/s12905-018-0565-5), there was an improvement in bloating with a mean change from baseline of -0.54 which was determined to be statistically significant with a p value of 0.01. In the RCT conducted by Maged et al (*Arch Gynecol Obstet.*2018;297(4):951-959. doi:10.1007/s00404-018-4664-1), there was improvement in bloating with a mean change from baseline of -55.05, which was determined to be statistically significant with a p value of 0.0001. In the case series analysis from the study conducted by Vishnupriya and Rajarajeswarma (*J Obstet Gynaecol India.* 2011;61(6):675-685. doi:10.1007/s13224-011-0117-5), there was improvement in bloating noted with a mean change of -2.65 which with a p value of 0.000 was found to be statistically insignificant.

CONCLUSION: While a reduction in bloating symptoms was found by all three studies based on a decrease in mean change from baseline, the statistical significance was variable across the studies. Due to high variability and limitations across all three studies, further research is needed to better evaluate the effects of aerobic exercise on reduction of bloating symptoms in individuals with PMS.

KEY WORDS: aerobic exercise, bloating, swelling, premenstrual syndrome, PMS

INTRODUCTION

Premenstrual syndrome (PMS) is a disorder characterized by hormonal changes during the luteal phase of the menstrual cycle in certain women.[1] It consists of a combination of behavioral and physical symptoms that occur cyclically during the 5 days before the onset of menses (luteal phase), are present for at least 3 consecutive cycles, and interfere with some aspect of daily life.[2] PMS can present any time after menarche and commonly presents in early 20s and can persist until menopause.[2] The affect the symptoms of PMS can have on quality of life varies by individual. More moderate to severe symptoms are associated with decreases in productivity, absenteeism from work or school, and an increase in healthcare visits.[2] There are a vast array of symptoms that have been linked to PMS; common physical and behavioral symptoms include, but are not limited to, abdominal bloating, fatigue, breast tenderness, headaches, hot flashes, mood swings, irritability, depressed mood, increased appetite, emotional lability.

The vast array of both physical and behavioral symptoms and the large age range of women experiencing PMS means Physician Assistants (PAs) will encounter these patients in a variety of healthcare settings. While clinically significant PMS that interferes with daily living affects 3-8% of the general population;[2] some degree of PMS symptoms is experienced by 75-85% of women.[3]

A 2003 study found that over a two-year period, individuals with PMS accrued greater than $500 in out-of-pocket healthcare office visit costs specifically for the condition.[4] The same study also found that the odds of accruing this amount were twice as high for those with PMS versus those without this diagnosis.[4] The impact of a PMS diagnosis can also be measured through workplace productivity. Individuals with PMS reported a greater number of workdays

missed as well as number of days of reduced work productivity,[4] which can be thought of as an indirect cost of the condition. A 2005 study found that the indirect cost of PMS, was found to be approximately $4333 annually.[5]

The exact cause of PMS, nor why it occurs to varying degrees in some women versus others, is not fully understood.[2] The possible role of genetics predisposing some women to this condition is an area that is currently under exploration.[2] It is theorized that the ovarian sex hormones estrogen and progesterone interact with GABA receptors and serotonin, particularly during the luteal phase of menstrual cycle and this interaction contributes to the behavioral symptoms experienced during PMS.[6] It has been suggested that the response, as opposed to the specific concentrations of the sex hormones, plays a role in PMS symptoms as well.[7] The role of more peripheral mechanisms, such as calcium regulation, are also being explored as contributing to the physical symptoms of PMS.[7] Bloating/water retention, a common physical complaint in those with PMS, could be due to the hormonal fluctuations and effects on estrogen and progesterone on homeostatic set points in the body.[8]

A variety of treatments are utilized to help minimize PMS symptoms. Menstrual diaries are useful to track symptoms that occur during the luteal phase. Dietary changes, NSAIDs, oral contraceptive pills, antidepressants, behavioral therapy, supplemental vitamins, relaxation techniques and exercise are common treatments employed for improvement in PMS.[9] PMS has a vast array of symptoms and patients can presents with any combination of symptom type and severity; treatment is individualized to the specific patient's severity of symptoms and treatment preferences. It has been suggested that exercise may improve mood and some physical symptoms.[9]

This paper will evaluate the effect of aerobic exercise on bloating symptoms in PMS, which can cause social distress as well as physical discomfort. Aerobic exercise involves low to high intensity movements that utilizes the aerobic metabolism for cardiovascular conditioning.

OBJECTIVE

The objective of this selective EBM review is to determine whether "aerobic exercise decreases bloating sensation in females with PMS?"

METHODS

This paper evaluates 2 randomized controlled trials (RCTs) and 1 quasi-experimental trial (analyzed as a case series) evaluating the ability of aerobic exercise to reduce bloating symptoms experienced during PMS. The populations used in these studies were females of reproductive age previously diagnosed with PMS. Reproductive age is generally defined as any age from puberty until menopause. The intervention of the studies was weekly aerobic exercise. The treatment groups in the 2 RCTs performed weekly aerobic exercise and were compared to the control group which did not perform any exercise. In the quasi-experimental trial, the group analyzed in this selective review performed moderate intensity aerobic exercise. The outcomes measured were a change in bloating symptoms with aerobic exercise. The time periods of the trials varied. The questionnaires were completed through various points in the intervention period.

The articles were found using keywords "exercise AND premenstrual syndrome; aerobic exercise AND premenstrual syndrome" entered into PubMed, AMED, and Cochrane library. The articles were selected based on relevance to the clinical question in addition to the outcomes measured being meaningful to patients. All articles were published in the English language in peer reviewed journals between 2011 and 2018. Inclusion criteria in the search for articles

involved all studies published after 2009. Exclusion criteria involved studies published before 2009, and non-aerobic exercise. Statistics reported within all three studies were p- value and mean change from baseline. [10,11,12] Table 1 summarizes the demographics and characteristics of studies utilized in this EBM review.

Table 1: Demographics & Characteristics of Included Studies

Study	Type	# Pts	Age (yrs)	Inclusion Criteria	Exclusion Criteria	W/D	Interventions
Dehnavi[10] (2018)	RCT	65	Mean age 24yo (control) Mean age 25yo (intervention)	Regular menstrual cycles; PMS; score below 40 on Beck questionnaire	Current Pregnancy, participation in other sports programs, continuous use of medication, chronic disease, neurological or psychological disorders, hormone treatment, endocrinological diseases, having local lesions causing pain such as PID, severe depression	0	Aerobic training for 30mins, 3x/wk for 8 weeks
Maged[11] (2018)	RCT	100	18-25	Regular menstrual cycles (23-35d duration), clinically and medically stable, BMI 18-25kg/m^2, virgins	Cardiopulmonary or orthopedic problems, women taking hormonal drugs or drugs that affect hormones during the preceding 3months before participation, any abnormality in ovulation, those with PID	30	Swimming exercise 30min daily, 3x/wk for 3months (exercise was stopped on 1st 3 days of menstrual cycle and then resumed afterwards)
Vishnupriya[12] (2011)	Quasi-experimental (analyzed as case series)	20	17-21	Those meeting the ACOG criteria for PMS	CV disorders, thyroid disease, renal impair, taking meds for any systemic disease, non-menstruating girls, pregnant	1	Moderate intensity (HR 60-80% of max) aerobic exercise 4days/week for 6weeks

OUTCOMES MEASURED

The primary outcome measured in all three studies was change in reported PMS symptoms from pre- to post-intervention. This was measured differently in each study. Improvement in PMS symptoms was measured via symptom questionnaires provided by the researchers- the questionnaires of temporary determination of PMS,[10] premenstrual distress questionnaire and Daily Symptoms Report,[11] and Menstrual symptom questionnaire.[12] The questionnaires were completed by all participants at varying points during the intervention period as outlined in the individual studies. While in all studies participants completed questionnaires regarding several PMS related symptoms, this EBM review will be evaluating the effect of aerobic exercise specifically on the symptom of bloating sensation.

RESULTS

The studies by Dehnavi et al and Maged et al analyzed in this systematic review were RCTs examining the effect of exercise on boating in females with PMS. The study by Vishnupriya et al was analyzed as a case series for this systematic review examining the effect of moderate intensity aerobic exercise on bloating in females with PMS. The forms of aerobic exercise utilized in all three studies differed. All studies used continuous data that could not be converted to dichotomous data, and mean changes from baseline and p values were analyzed in the studies. In all studies, participants had a diagnosis of PMS prior to starting the study. In the two RCTs, regular menstrual cycles were part of the inclusion criteria as well. In Vishnupriya et al the inclusion criteria consisted only of ACOG criteria of PMS.

The study performed by Dehnavi et al involved a nonblinded RCT comparing the intervention of aerobic training exercises to a control group without an intervention, and the

effect on PMS symptoms reported by participants. Participants average age was 24 in the control group and 25 in the intervention group, individual age ranges were not outlined in the published study. Participants all attended Mashhad University and were randomly placed into intervention or control groups. This study had further exclusion criteria that was ongoing through the intervention including pregnancy, deviation of cycle length from normal, failure to complete the questionnaires for 3 consecutive days and 5 days interrupted, dissatisfaction with study and stress/adverse effect during study. The study started with 70 participants but 5 were excluded from results due to above criteria. The intervention group consisted of 35 participants and the control group consisted of 30 participants. The intervention group performed aerobic exercise movements 3 times per week for 30 minutes per session for a total of 8 weeks. The movements were taught through face-to-face meetings that took place over 2 months prior to the intervention starting. Each exercise session involved a 5-minute warm up and 5-minute cool down. Participants were to record their daily PMS symptoms. The control group did not perform any exercises but still completed daily PMS symptom questionnaires. Participants were monitored via phone calls made twice weekly by researchers and encouraged to record symptoms daily.

The Dehnavi study used the questionnaire of temporary determination of PMS completed by participants to determine bloating improvement with aerobic exercise. The individual questionnaires' response for bloating were averaged for the control and intervention groups before and after the 8-week period. The control group saw a -0.26±0.63 change in bloating whereas the intervention group saw greater improvement in bloating following weekly aerobic exercise, with a change of -0.54±0.88 change in reported bloating symptoms from start to end of

exercise regimen.[10] The calculated p value for this difference was 0.01.[10] This data is shown in Table 2. This study found a 0.54% improvement in bloating with an 8-week exercise regimen as opposed to a 0.26% improvement in bloating without exercise in the same period.[10] This study did not show a confidence interval, however a p-value of 0.01 comparing the difference between the mean of boating reported at the beginning and end of the study was reported to be statistically significant.[10]

Table 2: Bloating Improvement as Mean Change from Baseline ±SD pre and post intervention with P value[10]

	Control (n=30)	*Weekly Aerobic Exercise (n=35)*
Baseline, mean (SD)	1.34(±0.66)	1.34±0.88
End of 8 week	0.89±0.43	0.53±0.32
Difference	-0.26±0.63	-0.54±0.88
P value	n/a	0.01

The study by Maged et al involved a non-blinded RCT comparing the intervention of swimming as aerobic exercise to a control group and the effect on reported bloating symptoms. In this study, bloating was described as swelling. Participants were recruited from a community youth center. Ages ranged from 18-25years old with BMI of 18-25kg/m^2, with regular menstrual cycles (see Table1). At the start of the study, 100 participants were placed into intervention or control group using an automated randomized system. The intervention group started with 54 participants and the control began with 46. Of the intervention group, 17 did not follow the training program and 2 were lost to follow up; in the control group 11 were lost to follow up. Thus, for analysis, the researchers had a total of 35 participants in each group. The intervention group performed 30 minutes of swimming exercises, consisting of a 5-minute warm up on land, 5minutes of walking in the pool, 15 minutes of lap swimming, and 5-minute cool down. This

was performed 3 times per week for 3 months. Warm up and cool down exercises were provided to the participants. Exercise was paused on the first 3 days of the participant's menstrual cycle. The control group did not engage in swimming exercise.

In the Maged study, all participants completed a Daily Symptom Report that was completed at the start and end of the study. Bloating severity was set to a score of 0-4, 0 being no symptom and 4 being severe symptom that is overwhelming and/or results in inability to carry out their daily routine.[11] The control group reported a median score of 7 pretreatment and 6 post treatment while the intervention group reported a median score of 11 pretreatment and 4 posttreatment. The intervention group saw a 55.05% improvement in bloating following the swimming regimen while the control group saw an 8.33% improvement in bloating during the same 3-month intervention period.[11] The study did not show a confidence interval but the p valve of 0.0001 was said to be clinically significant.[11] This data is shown in Table 3.

Table 3: Bloating Improvement as Mean Change from Baseline and P value pre and post intervention[11]

	Control (n=35)	*Swimming Group (n=35)*	*P value*
Pretreatment (baseline) score	7	11	0.004
Posttreatment (3 month) score	6	4	0.27
Percent change from baseline	-8.33	-55.05	0.0001

The final study by Vishnupriya R. and Rajarajeswaram P. involved a quasi-experimental study that this paper will analyze as a case series evaluating the effect of moderate intensity exercise on bloating symptoms in PMS. In this study bloating is referred to as water retention. The exercise included warm up and cool down phases performed 4 days per week for 6 weeks.

Moderate aerobic intensity exercise is measured by a heart rate of 60-80% of heart rate maximum (HRmax).[12] Aerobic exercises were provided to participants. HRmax is calculated by 220-age of participant. Twenty participants that met the inclusion and exclusion criteria (see Table1) were selected from volunteers from the Puducherry community in India. Exercise was completed at each participant's individual residence and consisted of a warmup, upper body exercise, lower body exercise, and cool down phase. There was no set window of time for exercise, but heart rate had to reach a moderate intensity level.

Participants completed the Menstrual symptom questionnaire (MSQ) before and after each session. The MSQ is a self-reported questionnaire with questions poised under 5 groups (pain, concentration, behavioral change, autonomic reactions, water retention, negative affect, and arousal) with a 5 point answer scale of ranging from no problem to severe problem.[12] Regarding bloating/water retention, prior to the intervention period, the pretest mean was 15.35±2.32 and at the end of the study, the posttest mean was 12.70±2.34.[12] At the end of the 6 week intervention period there was a decrease of 2.65% in bloating symptom reported.[12] The confidence interval was not reported in this study but the p value of 0.000 was stated to not be statistically significant and that there was not significant improvement in bloating with intervention of moderate intensity exercise.[12] Data is shown in Table 4.

Table 4: Bloating Improvement as Pre and Post Moderate Intensity Aerobic Exercise Mean ±SD and P value[12]

Pretest Mean ± SD	*Posttest Mean ± SD*	*P value*
15.35±2.32	12.70±2.34	0.000

DISCUSSION

The two RCTs and one case series analysis discussed in this systematic review suggest that aerobic exercise could be incorporated into a treatment regimen for improvement in bloating in females with PMS. However, the significance of the improvement varied among the studies. While the studies did find a reduction in bloating symptoms with exercise, the degree of reduction was variable between each study. The Maged study found a 55.05% reduction in bloating symptoms with exercise,[11] while the Dehnavi study found a 0.54% reduction,[10] and the Vishnupriya and Rajarajeswaram study found a 2.65% reduction.[12] This variability could in part be due to flaws or limitations in the studies. All three studies appeared to allow the participants to perform their exercises in an uncontrolled setting, and the exercises performed varied across studies. While the Vishnupriya and Rajarajeswaram study did require participants to have HR levels between 60-80% of HRmax,[12] neither of the RCTs set a parameter for intensity of exercise.[10,11] This may have influence on improvement of bloating symptoms.

Another limitation in the studies was the smaller sample size; none had a sample larger than 100. As PMS symptoms are common across a large percentage of women, larger sample sizes could more accurately determine if there is a significant benefit of aerobic exercise for bloating. In research for this selective review, the search could be refined to include studies that used similar PMS questionnaires. All studies used different questionnaires which, depending on the wording and scale, could affect the participants response. Particularly in the Dehnavi study, the specifics of the questionnaire used were not outlined or readily identified in outside research. Interpretation of the results of this study were more difficult as the scale for questions asked was not known. Intervention duration, discussed in the results section, also differed among the studies. Further research could investigate if a specific exercise regimen length results in more significant improvement in bloating.

CONCLUSIONS:

While the three above studies found that aerobic exercise decreases bloating symptoms in patients with PMS, the degree of improvement in symptoms still needs further investigation. Maged et al. found a 55.05% improvement in bloating symptoms,[11] while the Vishnupriya & Rajarajeswaram study and Dehnavi et al study both found rather minimal improvement in symptoms of 2.65%[12] and 0.54%,[10] respectively. This great variability indicates that more research is necessary to determine the extent of improvement in bloating symptoms with aerobic exercise. Further studies with more uniform questionnaires, controlled settings of exercise, and consideration of other aspects of patient life such as diet, sleep schedule, stress level, and other non-pharmacological interventions are necessary to determine if aerobic exercise provides enough improvement in bloating symptoms to warrant widespread recommendation for its use in decreasing bloating symptoms.

While an improvement in bloating was found across the three studies, the large variability in improvement calls into question the true benefit that this intervention has on bloating reduction. Aerobic exercise is a cost-effective therapy that can be performed in a variety of settings without the need for a prescription or insurance approval and requires very minimal equipment. However, it may not be advantageous for all patients to engage in aerobic exercise, depending on the individual patient's risk versus benefit for engaging in such activity, particularly if there is not significant bloating improvement found with this treatment modality. The results of this systematic review reveal that while aerobic exercise could be incorporated into a current regimen for PMS to help with relief of the physical symptoms, the extent that bloating improvement would be seen by the patient is variable and requires further research.

REFERENCES

1. Yonkers KA, Casper RF. Epidemiology and pathogenesis of premenstrual syndrome and premenstrual dysphoric disorder. UpToDate. October 2019. https://www.uptodate.com/contents/epidemiology-and-pathogenesis-of-premenstrual-syndrome-and-premenstrual-dysphoric-disorder?search=pre%20menstrual%20syndrome&source=search_result&selectedTitle=3~150&usage_type=default&display_rank=3. Accessed December 10, 2020.

2. Yonkers KA, Casper RF. Clinical manifestations and diagnosis of premenstrual syndrome and premenstrual dysphoric disorder. UpToDate. September 2020. https://www.uptodate.com/contents/clinical-manifestations-and-diagnosis-of-premenstrual-syndrome-and-premenstrual-dysphoric-disorder?search=pre%20menstrual%20syndrome&source=search_result&selectedTitle=2~150&usage_type=default&display_rank=2. Accessed December 10, 2020.

3. Premenstrual Syndrome and Premenstrual Dysphoric Disorder: In Beckmann and Ling's Obstetrics and Gynecology. 8th ed. Philadelphia, PA: Wolters Kluwer; 2019: 363-368.

4. Borenstein JE et al. Health and economic impact of the premenstrual syndrome. *J Reprod Med.* 2003; 48(7): 515-524.

5. Borenstein J, Chiou CF, Dean B, Wong J, Wade S. Estimating direct and indirect costs of premenstrual syndrome. *J Occup Environ Med.* 2005 Jan;47(1):26-33. doi: 10.1097/01.jom.0000150209.44312.d1. PMID: 15643156.

6. Walsh S, Ismaili E, Naheed B, O'Brien S. Diagnosis, pathophysiology and management of premenstrual syndrome. The Obstetrician& Gynaecologist. 2015;17:99-104. doi: 10.1111/tog.12180.

7. Office of Women's Health. Premenstrual syndrome (PMS). 2018. https://www.womenshealth.gov/menstrual-cycle/premenstrual-syndrome#:~:text=Premenstrual%20syndrome%20(PMS)%20is%20a,bloating%2C%20headaches%2C%20and%20moodiness. Accessed November 22, 2020.

8. Stachenfeld NS. Sex hormone effects on body fluid regulation. *Exerc Sport Sci Rev*. 2008;36(3):152-159. doi:10.1097/JES.0b013e31817be928.

9. Yonkers KA, Casper RF. Treatment of premenstrual syndrome and premenstrual dysphoric disorder. UptoDate. November 2020. https://www.uptodate.com/contents/treatment-of-premenstrual-syndrome-and-premenstrual-dysphoric-disorder?search=pre%20menstrual%20syndrome&topicRef=7380&source=see_link#H893014453. Accessed November 22, 2020.

10. Dehnavi ZM, Jafarnejad F, Goghary SS. The effect of 8 weeks aerobic exercise on severity of physical symptoms of premenstrual syndrome: A clinical trial study. *BMC Womens Health.* 2018;18(1):80.doi:10.1186/s12905-018-0565-5.

11. Maged AM, Abbassy AH, Sakr HRS, et all. Effect of swimming exercise on premenstrual syndrome. *Arch Gynecol Obstet.*2018;297(4):951-959. doi:10.1007/s00404-018-4664-1.

12. Vishnupriya R, Rajarajeswaram P. Effects of aerobic exercise at different intensities in pre menstrual syndrome. *J Obstet Gynaecol India.* 2011;61(6):675-685. doi:10.1007/s13224-011-011.