COMPARISON OF PREVALENCE OF PREMENSTRUAL SYNDROME IN SWIMMER AND NON-SWIMMER STUDENTS: A HISTORICAL COHORT STUDY

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Abstract- A number of studies have examined the role of aerobic exercise and evidence suggests this may be an effective therapy for premenstrual syndrome (PMS). The aim of this study was to assess the PMS symptoms between swimmer and non-swimmer female students. A total of 280 subjects were studied: 140 subjects were swimmers, while 140 were normal sedentary controls. Duration of swimming per week, and the length of exercise were asked from the case group. The predominant symptom of PMS was determined. PMS occurred in 36.2% and 22.8% of non-swimmers and swimmers, respectively (P = 0.00). The prevalence of premenstrual symptoms differ in the two group studied. There was no complaint about items asked in 35 (25%) and 13 (9.9%) of swimmers and non-swimmers, respectively (P = 0.000). In 11 (7.9%) swimmers, there was a problem in more than 50% of items asked, whereas 48 (17.1%) non-swimmers had complaints in this range (P = 0.00). The prevalence of feeling more irritable, tend to eat more than usual or at irregular hours, easily distracted, restless behavior noticeable by others, feeling more angry, physical symptoms, change in mood without obvious reason, significant swelling in breasts, ankles, and abdomen, marked change in sexual desire, avoiding some social commitments, and decreasing desire to have communication with males were significantly lower in swimmers. Aerobic exercise has been found in epidemiologic studies to be associated with fewer reported premenstrual symptoms. Swimming is one of aerobic exercises which can be used in relation to this issue.

Acta Medica Iranica 2008; 46(4): 307-313.

Key words: Premenstrual syndrome, aerobic exercise, swimming

INTRODUCTION

The average normal woman's experience of the menstrual cycle is rarely described in literature. It is expected that most women have some set of physical, emotional, and cognitive experiences associated with impending menstruation. Menstruation related symptoms have already been reported in 80% to 95% of women (1-4). Such experiences which are abnormally debilitating are considered symptoms of an illness defined as premenstrual syndrome (PMS) (5). Although PMS has been long recognized, there has been considerable difficulty both in reaching a consensus on diagnostic criteria and in arriving at a definition of clinically significant situation.

Received: 28 Jul. 2006, Revised: 11 Oct. 2006, Accepted: 17 Feb. 2007

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In April 2000 the American College of Obstetricians and Gynecologists (ACOG) published a practice bulletin on the topic of PMS that included criteria for diagnosis and recommendations for the treatment of clinically significant PMS (6).

Complementary/alternative therapies have grown in popularity in recent years, and a population survey in the United States showed that they have been used more by women (39%) than men (31%) (7). Surveys of women in the United States and United Kingdom found that those with PMS had tried a range of complementary/alternative therapies including diet, yoga, massage, exercise, faith healing, hypnosis, Chinese herbs, acupuncture, chiropractic, meditation, homeopathy, and vitamins/supplements (8-9). Exercise as an approach to treatment of specific conditions is often overlooked in the practice of conventional medicine. In the case of PMS, a number of studies have examined the role of aerobic exercise and evidence suggests this may be effective therapy for PMS (10). In a large survey on over 1,800 women, authors found out that exercise was used by over half of the women as a self-help method for alleviating PMS symptoms (11). Of those reporting exercise as a self-help method, over 80% found it to be helpful.

To our knowledge, there is no study to determine the effect of a special kind of sport on PMS in literature. Therefore the aim of this study was to assess the difference of prevalence of PMS and premenstrual symptoms between swimmer and non-swimmer female university students.

MATERIALS AND METHODS

Participants in this study were selected from students of Tehran University of Medical Sciences in Tehran, Iran, from March 2005 to October 2005. Students who swam 12 hours or more per month for at least preceding six months were identified and included in case group. Control group was selected from students matched for the grade and faculty. The study was approved by Ethics Committee of Tehran University of Medical Sciences. Written informed consent was obtained from all subjects.

All of the patients had regular menstrual cycles of 23–35 days. The presence of spontaneous ovulatory cycles was confirmed by history and a plasma Progestrone assay during the luteal phase. None of the patients had any psychiatric disorder as determined by the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (12-13). None of the subjects had used any hormonal drug during the 3 months before the study. All subjects were nonsmokers. 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 examination, and complete blood chemistry.

At the first visit, a questionnaire asking about age, time of menarche, marriage status, cycle length, duration of bleeding in a menstrual cycle, weight, and height, was handed over to the women. To determine PMS in subjects, we used the criteria of ACOG (6). The diagnosis of PMS requires that symptoms be confined to the luteal phase, with a symptom-free period before ovulation each month. By assessing the completed daily symptom calendar, we can determine whether the patient's symptoms follow a cyclical pattern or not. Symptoms which are not confined to the luteal phase do not represent PMS and instead may indicate another disorder (6, 12). Therefore the presence of premenstrual symptoms was determined and confirmed by a daily symptom calendar which was filling in during the three forthcoming menstrual cycles. Symptoms, which repeated in two of three cycles, were recorded.

In a pilot study in PMS clinic of Shariati Hospital, patients with diagnosis of PMS were interviewed to determine predominant symptom of PMS by asking a single question: "What is the main problem in your premenstrual period?" Sixty patients were interviewed. These interviews highlighted 18 issues relating to PMS. An 18-item daily symptom calendar was devised in relation to the answers obtained from the pilot group. The participants were asked whether the symptoms were as severe as to suffer from identifiable dysfunction in social or economic performance.

A total of 280 subjects with mean age of 20.6 ± 3.1 years were studied. One hundred forty subjects were swimmers, while 140 were normal sedentary controls. The sample size has been estimated with $\alpha < 0.05$ and β of 0.2. Sample size calculations were based on the data of a large study on 1800 women, which found that exercise was effective for alleviating of PMS symptoms in 80% of the patients (11). The incidence of PMS is approximately 4.9-16.2% (14-16). To find a difference in the prevalence of PMS in swimmer and non-swimmer subjects with a power of 80%, a sample size of 140 patients in each group was found to be adequate.

Results were reported as percentile and mean ± SD. Data analysis was carried out using Statistical Package for Social Sciences version 11.0 (SPSS, Chicago, IL). Statistical analysis was conducted by Student's *t* test, Chi-square, Fisher's exact and Mann-Whitney U test as appropriate. A *P* value of < 0.05 was considered statistically significant.

RESULTS

The main characteristics of the studied population are described in Table 1. Swimmer and non-swimmer groups were comparable in terms of menarche. There were no significant differences in the mean cycle length, mean days of bleeding in a menstrual cycle, and percentile of married subjects. However, we did note a significant difference in the mean age and BMI (Table 1).

Based on ACOG criteria (suffering from identifiable dysfunction in social or economic performance due to at least one premenstrual symptom), premenstrual syndrome occurred in 50 (35.7%) and 32 (22.9%) of non-swimmers and swimmers, respectively (OR = 0.53, 95% CI 0.32-0.9, *P* < 0.02). As attributable risk was -12.9%, swimming theoretically could prevent 12.9% of cases with PMS.

There was no complaint about asking items in 35 (25%) and 13 (9.9%) of swimmers and non-swimmers respectively (*P* < 0.00). We found a threefold decrease in the risk of occurrence of premenstrual symptoms in swimmers (OR = 0.3, 95% CI 0.15-0.61).

"Becoming more easily fatigue" (43.6%) and "feeling like crying" (46.4%) had the highest prevalence in non-swimmers and swimmers respectively while the lowest prevalence belonged to "reduced sexual desire" (16.4%) in both groups.

Median number of premenstrual symptoms was significantly lower in swimmers than non-swimmers (3 versus 4, *P* = 0.00 Z = -3.1). There was a statistically significant difference between groups in reporting 8 or more up to 12 symptoms. It was significantly lower in swimmers than non-swimmers (Table 2).

To determine whether the prevalence of each problem cited by participants differ in swimmers and non-swimmers, we performed analysis on the answer to each question separately (Table 3). There was a significant difference between the prevalence of eight items. The prevalence of feeling more irritable, tend to eat more than usual or at irregular hours, easily distracted, restless behavior noticeable by others, feeling more angry, physical

Table1. Characteristics of study and comparison population*

Characteristic	Swimmers	Non-swimmers	*P* value
Age (years)	20.00 ± 2.88	21.22 ± 3.19	0.001
BMI (kg/m²)	21.39 ± 2.50	22.16 ± 2.94	0.01
Married†	20 (14.3%)	26(18.6%)	NS
Age of menarche (years)	12.78 ± 1.54	12.42 ± 1.64	NS
Days of bleeding (day)	29.59 ± 2.18	29.54 ± 2.39	NS
Cycle length (day)	5.86 ± 1.31	5.87 ± 1.22	NS

Abbreviations: BMI, body mass index; NS, not significant.
* Data are given as mean ± standard deviation unless specified otherwise.
† Data are given as number (percent).

Table 2. Comparison of prevalence of multi-symptomatology between swimmers and non-swimmers*

Number of premenstrual symptoms	Swimmers (n= 105)	Non-swimmers (n= 127)	*P*
≥ 2	89 (84.8)	107 (84.3)	NS
≥ 3	76 (72.4)	93 (73.2)	NS
≥ 4	63 (60)	84 (66.1)	NS
≥ 5	52 (49.5)	64 (50.4)	NS
≥ 6	47 (44.8)	55 (43.3)	NS
≥ 7	33 (31.4)	47 (37)	NS
≥ 8	21 (20)	42 (33.1)	0.02
≥ 9	14 (13.3)	36 (28.3)	0.00
≥ 10	11 (10.5)	28 (22)	0.01
≥ 11	9 (8.6)	24 (18.9)	0.02
≥ 12	6 (5.7)	16 (12.6)	0.05
≥ 13	4 (3.8)	12 (9.4)	0.07
≥ 14	2 (1.9)	6 (4.7)	NS
≥ 15	1 (1)	4 (3.1)	NS
≥ 16	0	3 (2.4	NS
≥ 17	0	2 (1.6)	NS
≥ 18	0	1 (0.8)	NS

Abbreviation: NS, not significant.
* Data are given as number (percent).

symptoms, change in mood without obvious reason, significant swelling in breasts, ankles, and abdomen, marked change in sexual desire, avoiding some social commitments, and decreasing desire to have communication with males were significantly lower in swimmers (Table 3).

Table 3. Comparison of symptoms between swimmers and non-swimmers*

Complaint in the three past luteal phase	Swimmers (n=140)	Non-swimmers (n=140)	*P*
Feeling like crying	65 (46.4%)	58 (41.4%)	NS
Becoming more easily fatigue	50 (37.5%)	61 (43.6%)	NS
Increased desire for specific kind of foods	48 (34.3%)	59 (42.1%)	NS
Difficulty in completing daily work	39 (27.9%)	37 (26.4%)	NS
Feeling more irritable	36 (25.7%)	56 (40%)	0.001
Feeling tense and restlessness	36 (25.7%)	35 (25%)	NS
Being more forgetful or unable to concentrate	36 (25.7%)	35 (25%)	NS
Tend to eat more than usual or at irregular hours	32 (22.9%)	48 (34.3%)	0.034
Easily distracted	31 (22.1%)	46 (32.9%)	0.045
Restless behavior noticeable by others	27 (19.3%)	43 (30.7%)	0.027
Feeling more angry	25 (17.9%)	56 (40%)	0.000
Preferring to be alone	24 (17.1%)	33 (23.6%)	NS
Physical symptoms	24 (17.1%)	43 (30.7%)	0.008
Change in mood without obvious reason	20 (14.3%)	44 (31.4%)	0.001
Significant swelling in breasts, ankles, and abdomen	18 (12.9%)	37 (26.4%)	0.004
Marked change in sexual desire	10 (7.1%)	23 (16.4%)	0.01
Avoiding some social commitments	7 (5%)	18 (12.9%)	0.02
Decreasing desire to have communication with males	5 (3.6%)	19 (13.6%)	0.003

Abbreviation: NS, not significant.
* Data are given as number (percent).

DISCUSSION

This investigation was a historical cohort study. It was conducted to compare the prevalence of PMS and premenstrual symptoms between swimmer and non-swimmer female students.

PMS is a generic term, which includes a broad group of emotional, behavioral, and physical symptoms that occur for a period before menstruation and subside following the menstrual period. Many women experience PMS, particularly physical symptoms such as breast tenderness and swelling, at some time in their reproductive years, but do not perceive these symptoms as either distressing or debilitating (17). An enormous range of symptoms has been described. The character of the symptoms is less important than their timing and severity.

For the diagnosis of PMS, the symptoms must occur in the luteal phase of the cycle, resolve by menstruation, and be severe enough to have major impact on normal function. Data from the Zurich cohort studies suggest that in the 21–35 year age group, approximately 8% of women have severe premenstrual symptoms and another 14% have moderate symptoms (18). Severe and debilitating symptoms which reach a severity of a disorder were reported in at least 3–10% of women with menstrual related symptoms (18-20).

In our study, the prevalence of PMS was 35.7 % in non-swimmers. In control group, 90.1% of participants had at least one premenstrual symptom. Menstrual related symptoms have been reported in up to 80% of women (1, 2). To review premenstrual disorders, their varied symptoms, possible etiology, and treatment options, Frackiewicz *et al.* searched published articles identified through MEDLINE (1966-2001). PMS referred to a group of menstrual related disorders that were estimated to affect up to 40% of women of childbearing age (21). On the other hand, in a small study healthy women sampled from population were asked to describe menstrual symptoms and explain the phenomenon of premenstrual tension. Although there were differences in timing and severity of emotional symptoms, most women in the study viewed their experiences as common and normal. The authors believed most women dealt with menstrual experiences in the same way they handled other daily life stressors (22). Bias in predicting prevalence of PMS may introduced by personal characteristics, the nature of social and economic activities and the use of negative slant in devising questionnaires (23).

The high values of prevalence of PMS and premenstrual symptoms in our study are assumed to be due to higher degrees of education and corresponding activities. It seems that high-educated people pay attention and seek help for their medical problems more than general population. Moreover premenstrual symptoms interfere more with work efficiency in some special sort of jobs.

The main purpose of this study was to describe the difference of prevalence of PMS and premenstrual symptoms in swimmers and non-swimmers. We tried to study a group of patients who were likely similar in factors which could affect the results of our analysis. The two groups were similar in characteristics such as time of menarche, mean cycle length, mean duration of bleeding in a menstrual cycle, and percentile of married subjects. However a significant difference in the mean age and body mass index (BMI) was found (Table 1). In spite of statistically significant difference in mean value of age between the two groups, the approximately one year difference is not clinically impressive. Mean of BMI in our two groups was within the normal range. Therefore, the statistically significant difference between BMI of the two groups seems not to have clinical value.

The prevalence of PMS was found to be lower in swimmers. Aganoff *et al.* also surveyed exercisers and non-exercisers to determine the effects of regular, moderate exercise on mood and menstrual cycle symptoms (24). Regular exercisers obtained significantly lower scores on impaired concentration, negative affect, behavior change, and pain compared to control.

We compared the prevalence of each item asked between the two groups separately. As shown in Table 3 there were eight items which the prevalence of abnormal answer was significantly lower in swimmers than non-swimmers. Feeling more irritable, tend to eat more than usual or at irregular

hours, easily distracted, restless behavior noticeable by others, feeling more angry, physical symptoms, change in mood without obvious reason, significant swelling in breasts, ankles, and abdomen, marked change in sexual desire, avoiding some social commitments, and decreasing desire to have communication with males were significantly lower in swimmers.

The effect of exercise on mood was also demonstrated in other studies. Prior *et al.* assessed mood symptoms over a 6-month period in 8 sedentary women who began to exercise and 7 runners who began training for a marathon. Six women who kept their activity level the same considered as a control group. Both groups who increased activity were found to have a reduction in premenstrual mood symptoms compared to the control group (25). Similarly, mood and physical symptoms of 143 women including competitive sportswomen, high exercisers, low exercisers and sedentary women were monitored in three phases of the menstrual cycle (mid-cycle, premenstrual, and menstrual) in another study. High exercisers experienced a greater positive affect and the least negative affect. Sedentary women experienced the least positive affect (26).

The effects of aerobic and strength training exercise in a three-cycle randomized controlled (but not blinded) study of 23 healthy premenopausal women were investigated. The authors found that women participating in both groups had overall improvement in many premenstrual symptoms. The aerobic group showed improvement on more symptoms overall, especially premenstrual depression (27). It is remarkable that swimming is considered as an aerobic exercise.

Over 300 different premenstrual symptoms have been described in literature (15). Although common premenstrual symptoms including irritability, depression, anxiety, impulsivity, liability of mood, bloating, headache, and breast tenderness (mastalgia) were studied in this investigation, we emphasize that a number of premenstrual symptoms were introduced in other studies, which were not mentioned here. Thus, in prospective studies, other symptoms should be included and other more sensitive tools should be used.

The interpretation of our findings needs to take into account some considerations. First, the design of study is historical cohort. It would seem to be essential to design randomized trials. Second, it has been hypothesized that the two groups are similar, although socioeconomic factors might confound the results. Nevertheless, our findings support that exercise can be an alternative therapy to relieve premenstrual symptoms. However, the question that which type and degree of premenstrual symptoms would gain positive effects from exercise is still unanswered.

Conflict of interests

The authors declare that they have no competing interests.

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