Original Study

Fish Consumption and Premenstrual Syndrome and Dysphoric Disorder in Japanese Collegiate Athletes

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A B S T R A C T

Study Objective: To determine the specific characteristics of premenstrual syndrome (PMS)/premenstrual dysphoric disorder (PMDD) in Japanese collegiate athletes, with a focus on their fish consumption.
Design: Cross-sectional study.
Setting: A university in Osaka, the largest city in western Japan.
Participants and Interventions: The participants were 312 female collegiate students. The study group was composed of 200 students who were members of sport clubs, and the control (nonathletes) group was composed of 112 members of cultural clubs.
Main Outcome Measures: Premenstrual symptoms and social activities.
Results: The prevalence of moderate to severe PMS and PMDD in the study group was the same as in nonathletes. The prominent feature of premenstrual symptoms in athletes was that the severities of 'physical symptoms' and 'performance in training or competition' were much greater than those of nonathletes ($P = .003$ and $P = .002$, Mann−Whitney U test). There was a greater effect of PMS and PMDD on athletes, affecting their physical symptoms and performance compared with nonathletes. In terms of dietary habits, 'fish or dried fish' consumption was associated with a decreased risk of poor performance in athletes (odds ratio, 0.61; 95% confidence interval, 0.40-0.92).
Conclusion: The results from this study indicate that fish consumption might be positively associated with the relief of PMS/PMDD-induced athletic disturbance.
Key Words: PMS, PMDD, Athletic performance, Fish consumption

Introduction

Premenstrual syndrome (PMS) is a complex collection of mood, behavioral, and physical changes that are limited to the premenstrual phase and recover at the start of menstruation.[1] Epidemiologic surveys have shown that the frequency of premenstrual symptoms is high (80%-90%).[2] In approximately 5% of women, the symptoms are so severe that they interfere with personal or social relationships.[3] The Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV[4] defined such severe PMS as premenstrual dysphoric disorder (PMDD). In the DSM-IV PMDD was considered a form of depressive disorder.

In the past 40 years, female athletic participation has increased, particularly at high school and collegiate levels.[5] Many reports have documented that the premenstrual phase is associated with decreased performance,[6,7] but there are few reports about PMS/PMDD in athletes. Previously, we reported that PMS and PMDD are common menstrual problems in female collegiate athletes, and almost half of athletes perceived a negative effect of premenstrual symptoms on athletic performance.[8] Stress exposure could result in persistent alterations in

neuroendocrine systems and induce PMS/PMDD.[9] Intensive training and competitive anxiety could induce great stress in athletes.

The precise pathogenic mechanisms of PMS and PMDD are not yet known. The causes of PMS and PMDD have been suggested to include hormonal changes, serotonergic dysfunction, poor dietary habits, stress, and lack of exercise.[10] Among these factors, dietary changes or supplements could be recommended as nonpharmacological medical approaches. Fish consumption has been identified as a protective factor against many diseases, and epidemiological studies have shown a strong negative association between depression and fish consumption.[11,12] Fish is a major source of omega-3 fatty acids, such as eicosapentaenoic acid and docosahexaenoic acid, and supplementation of omega-3 fatty acids has been shown to be good for the relief of depression.[13] One previous report showed that omega-3 fatty acids had beneficial effects for the relief of PMS symptoms,[14] but data on the association between PMS/PMDD and fish consumption are lacking.

Stress exposure can result in persistent alterations in the neuroendocrine system and induce PMS/PMDD,[9] and intensive training and competitive anxiety can induce great stress in athletes. On the basis of these considerations, PMS/PMDD in athletes could show unique properties.

The aim of this study was to investigate the properties of PMS/PMDD in Japanese collegiate athletes compared with nonathlete students, and especially in relation to fish consumption.

Materials and Methods

The study was carried out in accordance with the principles outlined in the Declaration of Helsinki. Our institutional review board at Kinki University approved the study.

Study Population

A school-based cross-sectional survey was conducted in July 2014 using a sample of 368 Japanese female collegiate students at Kinki University in Osaka, the largest city in western Japan. All subjects belonged to authorized university sports or cultural clubs. In total, 225 students were members of sport clubs and 143 students were members of cultural clubs. All subjects were undergoing intensive training. We selected students who belonged to cultural clubs as nonathletes; these students belonged to orchestra, mandolin, easy listening music, traditional Japanese music, and drama clubs. We recruited female students who had regular menstrual cycles (22-35 days) and were able to provide informed consent. None of the subjects had a previous diagnosis of a psychological disorder.

Questionnaire

We used the Premenstrual Symptoms Questionnaire (PSQ), which was developed in our previous study,[15] to screen for premenstrual symptoms. The PSQ translates DSM-IV criteria into a rating scale with degrees of severity described in Japanese and is essentially identical to the Premenstrual Symptoms Screening Tool.[16] A translated summary of the PSQ is shown as Table 1. We divided students with premenstrual symptoms into 3 groups: 'PMDD,' 'moderate to severe PMS,' and 'no/mild PMS' according to the criteria reported previously.[15,16] In addition to the PSQ, we asked whether such premenstrual symptoms interfered with 'performance in training or competition.' An additional question also asked the students to rate the severity as 'not at all,' 'mild,' 'moderate,' or 'severe.' We also collected additional information about their age, participation in

national or international competition, and whether they were a regular player or not. Athletes were grouped into 5 groups: ball games, swimming, fighting sports, archery, and other sports. The other sports group consisted of yacht racing and triathlon. We asked the students about their severity of pain during menses with the categories of 'not at all,' 'mild,' 'moderate,' and 'severe.'

We collected information on dietary habits during the past month for seven foods. The foods investigated were, 'fish or dried fish,' 'fish paste,' 'squid, octopus, shrimp, or shellfish,' 'chicken,' 'pork or beef,' 'instant noodles,' and 'spaghetti, pasta or Japanese udon noodles.' The frequency of food consumption was divided into seven grades: none, less than once per week, once per week, 2-3 times per week, 4-6 times per week, once per day, and more than two times per day. These items were extracted from a brief, self-administered diet history questionnaire.[17]

Statistical Analyses

The Mann−Whitney U test was applied to test the difference in prevalence of menstrual pain and each premenstrual symptom between athletes and nonathletes. Multivariate analysis was applied to analyze factors that were significantly associated with reduced performance in training or competition. Statistical analysis was performed using JMP 10.0.2 (SAS, Cary, NC). Data are expressed as mean ± SD. Statistical significance was set at $P < .05$.

Post hoc power analysis was performed using the statistical power analysis program G*power3.[18]

Results

A total of 342 students completed the questionnaire. Thirty were excluded from the analysis because of incomplete data; therefore, we analyzed data from 312 students aged 18-23 years (average 19.7 ± 1.26 years).

The characteristics of the study population are presented in Table 2. Considering that half of the athletes participated in national or international competitions, all of these clubs have a high ranking in Japanese university sport.

The prevalence of menstrual pain and each premenstrual symptom is shown in Table 3. The prominent feature of premenstrual symptoms in athletes was that the severities of 'physical symptoms' and 'performance in training or

Table 1
Premenstrual Symptoms Questionnaire

(A) "Within the past 3 months, have you experienced the following premenstrual symptoms starting during the week before menses and ending a few days after the onset of menses?"
1. 'Depressed mood'
2. 'Anxiety or tension'
3. 'Tearful'
4. 'Anger or irritability'
5. 'Decreased interest in work, home, or social activities'
6. 'Difficulty concentrating'
7. 'Fatigue or lack of energy'
8. 'Overeating or food cravings'
9. 'Insomnia or hypersomnia'
10. 'Feeling overwhelmed'
11. 'Physical symptoms such as tender breasts, feeling of bloating, headache, joint or muscle pain, or weight gain'
(B) "Did any premenstrual symptoms interfere with the following activities?"
1. 'Work efficiency or productivity, or home responsibilities'
2. 'Social life activities'
3. 'Relationships with coworkers or family'
Rate the severity of premenstrual symptoms as:
'Not at all'   'Mild'   'Moderate'   'Severe'

Table 2
Characteristics of Study Participants (N = 312)

Characteristic	n (%)
Athletes	200 (100)
Type of sport	
High-impact sports	168 (84.0)
Ball games	73 (36.5)
Swimming	18 (9.0)
Fighting sports	72 (36.0)
Triathlon	5 (2.5)
Low-impact sports	32 (16.0)
Archery	28 (14.0)
Yachting	4 (2.0)
Participation in national or international competitions	117 (58.5)
Regular player	118 (59.0)
Nonathletes	112 (100)