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ORIGINAL ARTICLE

Prevalence of premenstrual syndrome and its psychological effects among university students who participate and do not participate in resistance training

Prevalência da Síndrome Pré-Menstrual (SPM) e seus efeitos psicológicos entre universitárias praticantes e não praticantes de treinamento resistido

Prevalencia del síndrome premenstrual y sus efectos psicológicos entre estudiantes universitarios que participan y no participan en el entrenamiento de resistencia

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Keywords
Resistance training;
Psychological symptoms;
Premenstrual tension;
Sedentary lifestyle.

ABSTRACT
The study aimed to investigate the prevalence and effects of premenstrual syndrome (PMS) on the psychological factors of university students who do and do not participate in resistance training. The initial sample consisted of 81 participants, and the prevalence of PMS was 64.2%. Forty women diagnosed with PMS were divided into two groups: women who participated in (GP) and did not participate in (GNP) resistance training. The intergroup comparison showed significant differences (with higher scores in the GNP) in the items: difficulty concentrating, lack of energy, and feeling under pressure, and they reported a greater influence of the symptoms on their family relationships. It is concluded that women who participate in resistance training have reduced indicators of some psychological symptoms of PMS.

Palavras-chave
Treinamento resistido;
Sintomas psicológicos;
Tensão pré-menstrual;
Sedentarismo.

RESUMO
O estudo objetivou investigar a prevalência e os efeitos da Síndrome Pré-Menstrual (SPM) nos fatores psicológicos de universitárias praticantes e não praticantes de treinamento resistido. A amostra inicial consistiu em 81 participantes, e a prevalência da SPM foi de 64,2%. Quarenta mulheres diagnosticadas com SPM foram divididas em dois grupos: praticantes (GP) e não-praticantes (GNP) de treinamento resistido. A comparação intergrupos apresentou diferenças significativas (com maiores escores do GNP) referentes aos itens: dificuldade de concentração, falta de energia, e sentindo-se sob pressão, tendo maior interferência dos sintomas em seus relacionamentos familiares. Conclui-se que mulheres praticantes de treinamento resistido apresentam indicadores reduzidos de alguns sintomas psicológicos da SPM.

Palabras clave
Entrenamiento de resistencia;
Síntomas psicológicos;
Tensión premenstrual;
Estilo de vida sedentario.

RESUMEN
El objetivo fue investigar la prevalencia y los efectos del síndrome premenstrual (SPM) sobre los factores psicológicos de las universitarias que practican y no practican el entrenamiento de resistencia. La muestra inicial consistió en 81 mujeres, y la prevalencia del SPM fue del 64,2%. Cuarenta mujeres diagnosticadas con SPM se dividieron en dos grupos: practicantes (GP) y no practicantes (GNP) de entrenamiento de resistencia. La comparación intergrupal mostró diferencias significativas (con puntajes de GNP más altos) con respecto a: dificultad para concentrarse, falta de energía y sentirse bajo presión, con una mayor interferencia de síntomas en sus relaciones familiares. Las mujeres que practican el entrenamiento de resistencia han reducido los indicadores de algunos síntomas psicológicos del SPM.

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INTRODUCTION

The menstrual cycle is a common biological process in healthy women who reach puberty. It occurs monthly and lasts 28 days on average, and its main characteristic is the interactions of sex hormones in the female body due to changes in the ovarian follicle (Ramos et al., 2018). These interactions are responsible for the good functioning of the cycle. This process entails three main distinct phases: the follicular phase, ovulation, and the luteal or premenstrual phase (Costa e Silva et al., 2017). The premenstrual phase, which occurs one week before menstruation, is the phase that has the greatest effects on the female body, generating premenstrual tension (PMT) (Lopes et al., 2019). Researchers in the fields of health and physical activity have investigated the possible benefits of exercise, such as the regulation of psychological symptoms, throughout the premenstrual period (Costa e Silva et al., 2017; Ramos et al., 2018).

Currently, a more intense version of PMT has gained increased attention in the scientific field: the premenstrual syndrome (PMS). PMS consists of physical, psychological and behavioral symptoms resulting from hormonal changes that occur cyclically, affecting physical, mood, cognitive and social aspects (Costa e Silva et al., 2017) and negatively impacting the quality of life of women (Ayaz-Alkaya et al., 2020). Del Mar Fernández et al. (2019) highlighted high associations between psychological variables such as stress and neuroticism with PMS.

Its precedents are unknown. However, studies (Del Mar Fernández et al., 2019; Foster et al., 2019) report that half of the world's population may be affected by PMS. In Brazil, 8 to 86% of the female population may have some of the symptoms of PMS, including anxiety, irritability, confusion, anger, and isolation, in addition to physical symptoms such as abdominal discomfort, headache, and swelling. The diagnosis can be made through self-assessment questionnaires, such as the Premenstrual Symptom Screening Tool (PSST) (Câmara et al., 2017), which offer cross-sectional versions that can provide a retrospective view of previous cycles.

PMS can affect the entire female population of childbearing age, and cases have been reported in sports teams (52 athletes, 59.6% affected) (Foster et al., 2019), schools and universities (80 students, 56% affected) (Shobeiri et al., 2018), indicating a negative impact on women's activities and learning. In most cases, women use medication to control symptoms. However, other studies (Costa e Silva et al., 2017; Mendes e Souza, 2017), including a systematic review of 17 articles prepared by Saglam and Orsal (2020), show evidence that regular physical exercise has a positive impact on the prevention or control of PMS.

At the physical level, exercise, specifically resistance training, may not influence the performance of those who undertake it, and PMS symptoms do not seem to interfere with the performance of physical fitness components (Coswig et al., 2018). At the neural and psychological levels, physical exercise can have positive effects because it leads to the release of endorphins, a neurohormone responsible for reducing pain and producing feelings of pleasure and happiness. Exercise also balances the concentration of estrogen and progesterone in the body, which alleviates mood swings, in addition to reducing cortisol concentrations and thus reducing stress and the psychological symptoms that accompany it (Mohebbi-Dehnavi et al., 2017). These changes resulting from an active lifestyle can help regulate the psychological symptoms of PMS (Teixeira et al., 2013).

Therefore, exercise is recommended for the control and prevention of PMS. Costa e Silva et al. (2017) investigated whether PMS influenced participation in physical exercise in 129 university students. The authors found that the syndrome had a negative effect on exercise for most of the participants. A longitudinal study by Mohebbi-Dehnavi et al. (2017) monitored sedentary university students using a daily questionnaire of premenstrual symptoms for 4 months, and the intervention group performed aerobic gymnastics exercises in the last 2 months. The authors found a decrease in some psychological symptoms of PMS in the intervention group compared to the control group.

Given the wide scope of the disease and the damage it causes, there is a clear need for a diagnosis of PMS to understand whether exercise influences psychological symptoms. Despite advances in understanding the effects of physical exercise in reducing premenstrual symptoms (Teixeira et al., 2013), there is still a gap regarding the benefits promoted by the specific practice of resistance training. The objective of this study was to investigate the prevalence and impacts of PMS on the psychological characteristics of university students who do and do not engage in resistance training.

MATERIALS AND METHODS

SAMPLE

A total of 81 female university students from the state of Pará, northern Brazil, participated in the present study. After the exclusion criteria were applied, 40 women aged between 17 and 28 years were selected for a comparative analysis of psychological and premenstrual symptoms. Regarding marital status, 2 were married, 35 were single, and 3 were in a common-law marriage. Concerning motherhood, 36 participants do not have children. The participants were divided into two groups: women who performed resistance training (GP) and those who did not (GNP). These data are shown in Table 1. The exclusion criteria were irregular menstrual cycle, pregnancy, use of medication to control psychological diseases, reproductive diseases (endometriosis, polycystic ovary) and absence of PMS. The inclusion criterion for the group of active women was regular (at least twice a week) resistance training during

Table 1. Data of the sample.

Variables	GP (n=20)	GNP (n=20)	p
Age (years)	21.40±2.21	22.60±2.16	0.09
Menarche age	12.20±1.47	12.25±1.25	0.91
Weight (kg)	60.25±9.31	62.83±13.55	0.48
Physical exercise (days per week)	3.95±1.39	0.0±0.0	<0.0001*
Use of contraceptives	4 (20.00%)	11 (55.00%)	0.02**

*p < 0.05 (Student's t test); **p < 0.05 (Chi square test). GNP: Group of women who did not perform resistance training; GP: Group of women who performed resistance training.

the last 3 months, period of time considered adequate to promote the effects of physical exercise on the syndrome (Saglam and Orsal, 2020). Resistance training was considered from the enrollment of participants in gym classes, with training lasting 45 to 60 minutes. The inclusion criterion for the group of inactive women was a lack of exercise in the past 3 months.

INSTRUMENTS

A sociodemographic questionnaire was used to gather data on age, menarche age, weight, and weekly exercise level. These data were used to characterize the groups (GP and GNP). The psychological and physical factors potentially influenced by PMS were measured using the Premenstrual Symptoms Screening Tool (PSST), validated in Brazil by Câmara et al. (2017), which comprises 19 symptoms rated on a Likert scale with responses varying according to symptom severity: 0 (none), 1 (mild), 2 (moderate), and 4 (severe).

PROCEDURES

The participants were approached at the university. They were asked to complete the questionnaires at a location where there were no disturbances that would affect their concentration. All the ethical standards established by the Brazilian National Board of Health for Research involving human beings were respected. The participants signed an informed consent form.

DATA ANALYSIS

This is a case-control study with a retrospective analysis of 81 women and a comparative observation of premenstrual symptoms. For the diagnosis of PMS, the participant had to present the following PSST results: a) at least one symptom at a moderate or severe level from items 1 to 4; b) at least four symptoms at moderate or severe level from items 1 to 14; and c) at least one of the issues described in items 15 to 19 must be rated moderate or severe (Câmara et al., 2017). After diagnosis, a sample normality test was performed using the Shapiro-Wilk test. Given the nonparametric distribution of the data from the PSST, the Mann-Whitney U test was used to compare symptoms between groups at a significance level of $p < 0.05$. All analyses were performed using IBM SPSS Statistics, version 20.

RESULTS

The initial sample consisted of 81 women, 39 were physically active (48.1%) and 42 were sedentary (51.9%). After applying the inclusion and exclusion criteria for the comparison of psychological symptoms of PMS, the final sample included 40 participants (49.3%), with 20 women in each group.

In the comparison between the groups (Table 2), significant intergroup differences were observed for the items difficulty concentrating ($p < 0.02$), fatigue/lack of energy ($p < 0.03$), feeling under pressure or out of control ($p < 0.02$), and interference of symptoms with family relationships ($p < 0.02$). The GNP had higher values than the GP for all items for which differences were found.

DISCUSSION

The objective of this study was to investigate the prevalence and impacts of PMS on the psychological aspects of university students who or do not participate in resistance training. Regarding the prevalence, women affected by PMS accounted for 64.2% of the initial sample. Regarding psychological symptoms, the sample included women who did and did not use contraceptive methods. However, there were significant intergroup differences, with the women in the GNP reported greater perception of the following symptoms: difficulty concentrating, fatigue/lack of energy, feeling under pressure or out of control, greater interference of symptoms with family relationships.

In terms of the prevalence of PMS, a recent study of Bulgarian women indicated a lower PMS rate than we found in our Brazilian sample (Chumpalova et al., 2020). On the other hand, Shobeiri et al. (2018) found a high prevalence of PMS in the university population, which corroborates our findings. An official genesis or cause of the incidence of PMS has yet to be found. However, it is speculated that it may occur due to deregulations in the pathways of hormones such as serotonin, progesterone and estrogen, in addition to fatty acid deficiency (Mohebbi-Dehnavi et al., 2017; Yonkers and Simoni, 2018).

Because the study population was a university population, PMS may be linked to the stressful routine of school combined with pressure, anxiety and worry,

Table 2. PSST response index for the groups (median and interquartile range).

Items	GNP			GP			U	p
	Q1	MED	Q3	Q1	MED	Q3		
Anger/Irritability	2.00	2.00	2.00	1.00	2.00	3.00	197.50	0.93
Anxiety/Stress	1.00	2.00	3.00	0.25	2.00	3.75	149.00	0.13
Crying/Increased sensitivity to rejection	0.25	2.00	3.75	0.25	2.00	3.75	192.50	0.82
Depressed and hopeless mood	1.00	2.00	3.00	1.00	1.00	3.00	145.50	0.11
Lack of interest in work activities	0.00	2.00	4.00	1.00	2.00	3.00	148.50	0.14
Lack of interest in housework	0.00	2.00	4.00	1.00	2.00	3.00	161.00	0.27
Lack of interest in social activities	0.00	2.00	4.00	1.00	1.00	3.00	159.50	0.24
Difficulty concentrating	0.00	2.00	4.00	1.00	1.00	3.00	122.00	0.02*
Fatigue/Lack of energy	2.00	3.00	4.00	0.00	2.00	4.00	127.50	0.03*
Overeating/Desire to eat	1.00	3.00	5.00	1.50	2.50	3.50	189.00	0.74
Insomnia	0.00	1.00	2.00	0.00	0.50	1.50	148.00	0.13
Hypersomnia	0.00	2.00	4.75	0.50	1.50	2.50	176.00	0.50
Feeling under pressure or out of control	0.00	2.00	4.00	0.00	1.00	3.00	115.50	0.02*
Physical symptoms	2.00	3.00	4.00	1.50	2.50	3.50	181.00	0.55
Your above symptoms interfere with:								
Your productivity at work	0.25	2.00	3.75	1.00	2.00	3.00	144.50	0.10
Your relationships with colleagues at work	1.00	2.00	3.00	0.50	1.50	2.50	180.50	0.56
Your family relationships	1.25	2.00	2.75	1.00	2.00	3.00	127.00	0.02*
Your social activities and life	0.25	2.00	3.75	1.00	2.00	3.00	162.50	0.27
Your responsibilities at home	1.25	2.00	2.75	1.00	2.00	3.00	162.00	0.25

*p < 0.05. GNP: Group of women who did not perform resistance training; GP: Group of women who performed resistance training; U: Mann-Whitney U value; Q1: first quartile; MED: median; Q3: third quartile.

poor diet and irregular sleep, factors characteristic of the academic world (Orra and Ferraz, 2019). These aggravating factors, combined with hormonal imbalance, may accentuate premenstrual symptoms, resulting in psychosomatic impacts (Acikgoz et al. 2017; Lopes et al., 2019). Regarding psychological symptoms, women who did not exercise had more difficulty concentrating. This difference may be associated with the ability of exercise to increase adrenal cortisol levels, which aids concentration and balances mood changes and thus improves focus (Cicek, 2018; Virk et al., 2019; Abebe et al., 2019), especially during regular activities, which generates positive effects on both attention and academic performance. For university students, this effect is relevant to academic performance because concentration in school leads to better understanding of the studied subjects, thus generating high grades in evaluative activities and self-confidence among students (De Greeff et al., 2018).

The students who exercised felt less pressured and less out of control than those who did not participate in resistance training. Active women are more self-confident, indicating that physical exercise is responsible for reducing pessimistic thoughts and making women more optimistic (Maged et al., 2018; Virk et al., 2019). Physical exercise helps reduce PMS symptoms due to the production of beta-endorphins in the brain that increase feelings of pleasure and well-being (Mohebbi-Dehnavi et al., 2018; Abebe et al., 2019) and prevent diseases such as depression and anxiety, which are common among university populations (Foster et al., 2019; Yilmaz-Akyuz and Aydin-Kartal, 2019). Such mechanisms may help women with PMS who exercise feel less pressured or less out of control.

Another psychological factor that was more prevalent in women who did not participate in resistance training was fatigue, as they reported feelings of lack of energy during the premenstrual period. The lack of physical fitness resulting from inactivity can accentuate fatigue. In contrast, physical exercise improves cardiovascular activity and, consequently, oxygenation (Virk et al., 2019), delaying symptoms of fatigue. In addition, the endorphins produced during physical exercise have a relaxing effect, which is another reason why physically active women do not feel as fatigued as women who do not exercise (Cicek, 2018; Yilmaz-Akyuz and Aydin-Kartal, 2019).

According to our findings, all the symptoms presented in the questionnaire, especially difficulty concentrating, fatigue and lack of control, interfered with the family relationships of women who did not exercise. Studies indicate that women with PMS report an inability to perform all their daily activities during or before the menstrual period (Lopes et al., 2019; Schoep et al., 2019; Victor et al., 2019). This situation can lead to friction among family members. Another factor that may explain this behavior is coexistence in the family environment, which can lead to conflicts, especially if the environment is fragile (Sales, 2016). The relaxing and pleasurable

effects of exercise (Cicek, 2018; Mohebbi-Dehnavi et al., 2018) can mitigate negative emotions and reduce personal and interpersonal conflicts (Abebe et al., 2019).

The present study provides a step forward in understanding the effects of resistance training on the psychological symptoms of PMS in a sample of university students who do or do not participate in resistance training. However, we emphasize that other studies on this topic have used other sports or aerobic activities (Shobeiri et al., 2018; Mohebbi-Dehnavi et al., 2018; Foster et al., 2019; Virk et al., 2019). A possible limitation of the study is the inclusion of women who do and do not use contraceptives. The use of contraceptives may have no effects or positive effects on psychological factors (Taggart et al., 2018; Victor et al., 2019; Robakis et al., 2019). However, it is important to mention that the GNP was mainly composed (55%) by the contraceptive users and exhibited the highest levels of symptom severity. This observation suggests that the use of contraceptives may not significantly affect the incidence and the psychological symptoms of PMS.

CONCLUSION

According to the results of our study, approximately two-thirds of female university students were diagnosed with PMS. The university students who did not participate in resistance training had greater difficulty concentrating, a chronic lack of energy and feelings of being out of control. These psychological factors negatively affected their family relationships.

The conclusions reinforce the need for physical education professionals to understand PMS and the effects that it has on the health of women so that they can inform them about the benefits of physical exercise during the premenstrual phase. Further studies with larger samples in prospective trials and control of resistance training variables, such as volume and intensity, are suggested to expand the knowledge obtained in the present study.

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CONFLICTS OF INTEREST

No potential conflict of interest was reported by the authors.

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