Original Paper

Effect of Progressive Muscle Relaxation Technique on Signs and Symptoms of Premenstrual Syndrome Among Female Nursing Students

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ABSTRACT

Introduction: Premenstrual syndrome (PMS) stands as one the most prevalent health issues, especially among female university students. The syndrome substantially impacts their quality of life and academic performance. The progressive muscle relaxation technique is a calming method that can help lower anxiety, cultivate a sense of pain control, and divert away from the painful body part.

Objective: The study sought to determine the effect of progressive muscle relaxation technique on premenstrual syndrome among female nursing students.

Materials and Methods: A quasi-experimental study was conducted on 80 female students (40 students in the study group and 40 in the control group) enrolled in the third and fourth academic years (2020-2021). Students were randomly assigned to either the control or study group using a random number generator program. The progressive muscle relaxation technique was performed 30 minutes daily for 4 weeks. Baseline data were collected from all students. The premenstrual syndrome scale assessed the intensity of PMS before and after the intervention. Data analysis was performed using the chi-square test, the student t-test, the Monte Carlo test, the Mann-Whitney test, and the marginal homogeneity test. P<0.05 were considered significant.

Results: The study found that the Mean±SD age of the study and control group participants were 22.02+0.73 and 21.95+0.67 years, respectively. Also, more than two-thirds of the students in the study and control groups (70% and 67.5%, respectively) were from rural areas. After the intervention, a statistically significant decrease was observed in the intensity of all physical, psychological, and behavioral symptoms among the study group compared to the control group (P<0.05). In addition, the total score of PMS intensity was significantly decreased among the study group after the intervention (P=0.001). In contrast, the total score of the intensity of PMS symptoms was significantly increased in the control group (P=0.034).

Conclusion: The study concluded that young adult girls who practiced progressive muscle relaxation techniques exhibited less severe premenstrual syndrome symptoms than those who did not.

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Highlights

- Premenstrual syndrome is more common in female, young adults, and university students.
- The syndrome may negatively influence daily activities, interpersonal relationships, and health-related quality of life.
- Jacobson's progressive muscle relaxation technique effectively reduces the severity of premenstrual symptoms.

Plain Language Summary

Premenstrual syndrome has been blamed as a barrier for female adolescents and young adults during a critical period of their pursuit of developmental goals. This syndrome could affect daily activities, interpersonal connections, and quality of life. It negatively affects academic performance and family functioning. Given these circumstances, addressing the needs of female teenagers and young adults who experience these symptoms becomes more paramount. Therefore, this study assessed the effect of progressive muscle relaxation on premenstrual syndrome among female nursing students. The present study's findings demonstrated the beneficial effects of the progressive muscle relaxation technique on premenstrual syndrome symptoms.

Introduction

Premenstrual syndrome (PMS) is one of the most prevalent health issues among women worldwide. More than 90% of women during reproductive age may experience PMS—with prevalence rates spanning from 35.6% to 96.6% [1-3]. The syndrome is particularly prevalent among female university students and negatively affects their quality of life and academic performance. Reports on the prevalence of PMS among female university students exhibit regional variations; for example, it ranges from 39.4% to 56.9% in Iran and 65% in Egypt [4]. The exact etiology of PMS is unknown; it could possess a complex and multifactorial origin. PMS has been linked to over 200 physical, psychological, and behavioral symptoms. The main symptoms include breast tenderness, abdominal discomfort, mood swings, anxiety, and social isolation [5-7].

PMS has been seen as an obstacle for female teenagers and young adults as they strive to attain developmental goals. The syndrome may impede work productivity, decrease health-related quality of life, and interfere with interpersonal relationships and daily living activities [4]. Furthermore, it can result in a loss of self-esteem, foster social isolation, prevent academic achievement, and increase accident risk [8]. PMS control is best achieved through a combination of both pharmacological and non-pharmacological therapies. Non-pharmacologic methods empower individuals to control their emotions, decrease the feeling of weakness, improve the activity level, and enhance functional capacity. They also contribute to reducing the needed dosage of analgesic drugs, thus decreasing the side effects of treatment [9]. Cognitive and behavioral therapies, exercises, massage therapy, relaxation techniques, and dietary and nutritional modifications have been proven beneficial for treating premenstrual symptoms [10].

Jacobson's progressive muscle relaxation technique (JPMRT) represents a valuable relaxing method commonly used in nursing practice. This technique facilitates deep relaxation through a systemic sequential tensing of specific muscle groups (face, hand, shoulder, abdomen, and legs) for 5-7 seconds, followed by relaxing the same muscle group for 10-12 seconds. As a result, the approach serves as a mediator in the stress-response process, moderating emotional and physiological reactions to the stressor events. In addition, the hypothalamic response in Jacobson's approach reduces sympathetic arousal and muscular tone. Furthermore, this mechanism aids in the reduction of pain, distress, and anxiety, helps to divert attention away from a painful body part, and establishes a sense of control over pain [11, 12].

Sudhadevi et al. reported the positive outcomes of progressive muscle relaxation on PMS [13]. Similarly, Gayathri reported that muscle relaxation therapy would effectively reduce the severity of premenstrual symptoms [14]. Premenstrual syndrome is a growing concern for healthcare providers. The syndrome's physical, psychological, and behavioral manifestations may impair interpersonal relationships, academic performance, and health-related quality of life, as well as reduced

job productivity and a greater demand for specialist healthcare. As a result, it has a high health burden and social-economic cost. PMS management is a problem that can no longer be ignored. However, administering analgesics is not always effective in reducing the severity of PMS; rather, utilization of non-pharmacological interventions like PMS assists in symptom relief and increases individual feelings of pain control. So, there is a need for sparking research to explore these interventions' impact on PMS. Such knowledge paves the road for nurses to use safe, effective, easy-to-apply, and costless methods to control PMS.

Materials and Methods

This research is a quasi-experimental study employing a pre-test post-test design with two groups. The investigation was conducted at the Faculty of Nursing, Damanhur University in Egypt, at the Obstetrics and Gynecologic Nursing Skills Lab.

A convenience sampling was employed to recruit 80 female nursing students who fulfilled the following inclusion criteria: Suffering from mild or moderate degree of PMS according to the premenstrual syndrome scale (PMSS) and having a history of regular menstrual cycle ranging from 21 to 35 days, lasting from 3-7 days.

To choose the eligible subjects, the researchers interviewed all female nursing students enrolled in the third and fourth academic years during the second semester of 2020-2021. The selected cases were 97 students. Epi info program version 10 was used to estimate the sample size using the following parameters: Population size of 97, a confidence interval of 95%, an expected frequency of 50%, and an acceptable error of 5%. The minimum sample size required was determined as 77.

During the study period (from March until the end of July 2021), 80 out of 97 students who agreed to participate in the study were assigned to two Equal groups using a random number generator program: The study group (40 students) and the control group (40 students). Also, 17 students were removed because they did not practice PMS for 4 weeks (Figure 1).

The premenstrual syndrome scale (PMSS) was used in this study. PMSS comprised 40 items with three subscales: Physiological symptoms (16 items), psychological symptoms (12 items), and behavioral symptoms (12 items) as per the original instrument. The students' responses were rated on a 5-point Likert scale ranging from never=1 to always=5. the total scores ranged from 40 to 200, with higher scores indicating increased PMS severity. The students' PMS severity was categorized as follows: No symptoms (1-40), mild symptoms (41-80), moderate symptoms (81-120), severe symptoms (121-160), and very severe symptoms (161-200) [15]. We used the main questionnaire (designed in the English language) in this study.

We also used a sociodemographic data form including age, academic year, current residence, and menstrual history (age of menarche, interval, rhythm, duration, and amount of menstrual flow).

Top of form

Initially, the researchers interviewed students of both groups in the nursing skill lab on a weekday before menstruation, established rapport, and collected the sociodemographic data and menstrual history. Moreover, the baseline PMS symptoms severity was assessed.

The researchers explained to the study group how to perform progressive muscle relaxation using videos and pictures and demonstrated each step. The procedure included the following steps.

The student was asked to evacuate her bladder, lose tight clothes, and assume a comfortable position. The researcher instructed the student to inhale deeply through her nose, feel her abdomen rise, and slowly exhale out of her mouth. Then, she repeats 3-5 cycles of deep breathing.

Then, they were asked to tense the muscles of the face, wrinkle the forehead, frown on the nose, close their eyes very tightly, and purse their lips for 5-7 seconds. Then, they were asked to release the hold gradually while counting for 10 seconds. They were also instructed to tense the muscles of the hands, forearms, and biceps muscles. They were asked to clench their fists and hands and move on to the biceps by drawing the forearm up towards the shoulder, slowly bend the elbow using a strong 5-second contraction, then slowly releasing while counting to 10. After that, the researcher instructed the student to tense the shoulders and neck muscles. Hold them for 5 seconds and then slowly release them.

Also, the student was asked to suck and hold the abdomen for 5-7 seconds, then slowly release while counting for 10 seconds. Also, the subject was asked to tense the buttocks by pulling them together, hold for 5-7 seconds, and then slowly release while counting to 10. Finally, the

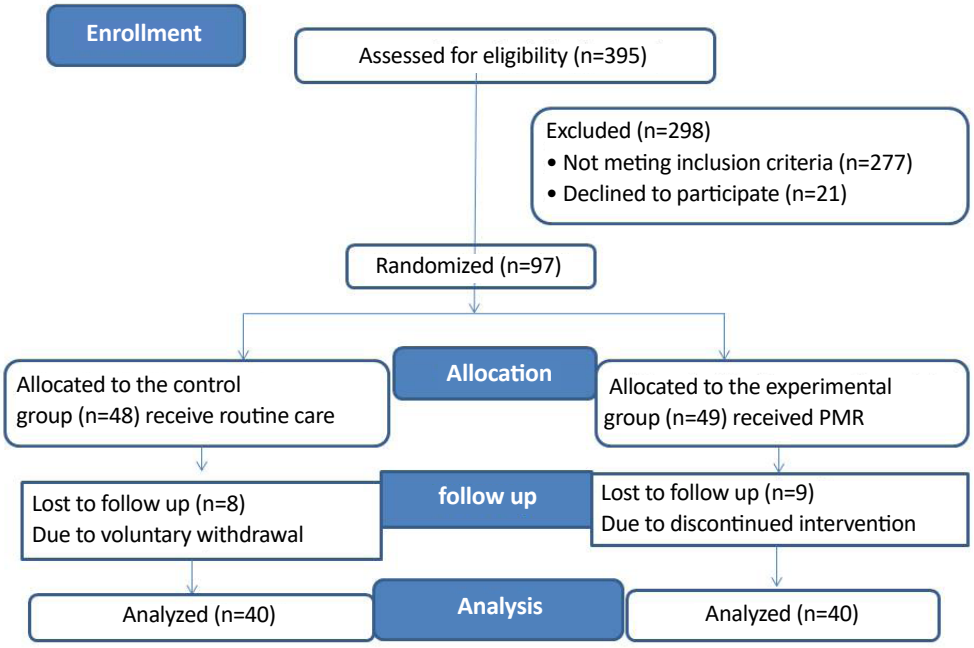

Figure 1. CONSORT flow diagram

researcher instructed the student to tense the muscles of the legs, lift the leg off the ground, straighten knees, and point toes toward the head. Hold them for 5 seconds and slowly release them while counting for 10 seconds.

After completing the explanation, each female student was asked to re-demonstrate it until the researchers ensured that the student could perform the technique on her own. At the end of the session, students were informed to practice progressive muscle relaxation for 30 minutes per day for 4 weeks. The researchers instructed every student about the importance of compliance with the intervention.

The control group included female students who received routine care such as warm drinks, warm baths, and low salt and fat intake. After 4 weeks, they were interviewed to reassess the severity of PMS symptoms. The intervention group received the intervention plus routine care.

The researchers contacted the students daily to ascertain their cooperation. Participants were also instructed to attend the nursing skills lab after 4 weeks for follow-up when the intensity of PMS symptoms was reassessed.

The SPSS software, version 20 was utilized for data analysis. Descriptive statistics, including frequency, percentages, the Mean±SD, were employed to describe demographic characteristics, menstrual history, and the intensity of PMS. Inferential statistics were used to compare the study groups, including the chi-square test, t-test, Monte Carlo test, and Mann-Whitney test, and Marginal Homogeneity test. All of the statistical analyses were considered significant at $P<0.05$.

Results

The Mean±SD age among the study and control groups was 22.02±0.73 and 21.95±0.67 years, respectively. Moreover, 70% of the study and 77% of the control groups were in their third academic year. More than 70% and 67.5% of the study and control groups were from rural areas, respectively. Also, 60% of the study group and 52.5% of the control group had their menarche at 12 to 16 years old. All students in both groups had a regular menstrual cycle, with intervals ranging from 21 to 35 days. Moreover, the duration of menstruation spanned 3-5 days among 72.5% of students in the study group and 67.5% of students in the control group (Table 1).

Before Intervention, no statistically significant differences were observed between the study and control groups in the mean intensity scores of all PMS physical symptoms except pelvic discomfort and pain (P=0.012). While after the intervention, there was a statistically significant decrease in the mean score of the intensity

Table 1. Sociodemographic characteristics and menstrual history of female students

Variables		Mean±SD/No. (%)		P
		Study Group (n=40)	Control Group (n=40)	
Age (y)		22.02±0.73	21.95±0.67	0.636*
Academic year	3rd year 4th year	28(70.00) 12(30.00)	31(77.50) 9(22.50)	0.581** 0.446**
Residence	Rural Urban	28(70.00) 12(30.00)	27(67.50) 13(32.50)	0.058** 0.809**
Age of menarche (y)	<12 12-16 >16	15(37.50) 24(60.00) 1(12.50)	17(42.50) 21(52.50) 2(05.00)	0.732***
Rhythm	Regular Irregular	40(100.0) 0(0)	40(100.0) 0(0)	-
Duration (d)	3-5 6-7	29(72.50) 11(27.50)	27(67.50) 13(32.50)	0.238** 0.808**

*Student t-test, **The chi square test, ***The Monte Carlo test.

Table 2. Intensity of premenstrual physical symptoms before and after the intervention

Physical Symptoms	Mean±SD		P*	Mean±SD		P*
	Before			After 4 weeks		
	Study (n=40)	Control (n=40)		Study (n=40)	Control (n=40)	
Breast tenderness and swelling	2.85±1.17	2.70 ±1.11	0.598	2.53±0.97	2.62±1.15	0.546
Abdominal bloating	3.08±1.05	3.30±0.85	0.399	2.70± 0.92	3.23±0.92	0.011
Weight gain	2.55±1.13	2.68±1.10	0.619	2.50±1.10	2.59±1.11	0.074
Headache	3.00±1.04	2.58±0.90	0.063	2.88±0.97	2.43±0.94	0.128
Dizziness/Fainting	2.73±1.06	2.63±1.00	0.718	2.00±0.93	2.53±0.93	0.010
Fatigue	2.83±0.87	2.95±0.85	0.433	1.75±0.59	2.90±0.85	0.001
Palpitations	2.45±1.04	2.40±0.84	0.890	1.70±0.69	2.30±0.91	0.002
Pelvic discomfort and pain	4.28±0.72	3.83±0.90	0.012	2.23±0.48	3.90±0.90	0.001
Abdominal cramps	4.18±0.68	3.98±0.58	0.098	2.30±0.52	4.13±0.52	0.001
Change in bowel habits	3.03±1.05	3.05±0.75	0.772	2.40±0.90	2.78±0.89	0.036
Increased appetite	2.03±1.05	1.98±1.00	0.858	1.75±0.81	1.93±1.02	0.615
Generalized aches and pains	3.88±0.69	3.75±0.49	0.213	2.53±0.93	3.73±0.4	0.001
Food cravings (sugar/salt)	2.15±0.86	2.33±0.76	0.272	2.03±0.80	2.38±0.81	0.044
Skin changes, rashes, pimples	2.23±1.05	2.40±1.08	0.485	1.85±0.92	2.33±1.00	0.028
Nausea/Vomiting	2.20±1.14	2.35±1.00	0.497	1.35±0.53	2.13±1.07	0.001
Muscle and Joint pain	3.85±1.03	3.95±0.81	0.901	2.50±1.01	4.00±0.82	0.001

*The Mann-Whitney test.

Table 3. Comparing premenstrual syndrome psychological symptoms before and after the intervention

Psychological Symptom	Mean±SD		P*	Mean±SD		P*
	Before			After 4 weeks		
	Study (n=40)	Control (n=40)		Study (n=40)	Control (n=40)	
Irritability	3.25±0.78	3.43±0.64	0.356	2.43±0.71	3.45±0.68	0.001
Anxiety	3.40±0.67	3.30±0.65	0.563	2.28±0.68	3.28±0.51	0.001
Tension	3.43±0.71	3.30±0.61	0.351	2.35±0.70	3.35±0.53	0.001
Mood swings	3.68±0.83	3.68±0.53	0.996	2.53±0.72	3.78±0.70	0.001
Loss of concentration	3.13±0.99	3.20±0.65	0.945	2.23±0.77	3.05±0.45	0.001
Depression	2.95±0.81	2.85±0.86	0.624	1.90±0.67	2.93±0.94	0.001
Forgetfulness	2.10±1.03	2.20±0.97	0.615	1.93±0.97	2.03±0.80	0.386
Easy crying/Crying spells	3.20±0.88	3.18±0.84	0.950	2.38±0.84	3.48±0.82	0.001
Sleep changes (insomnia/hypersomnia)	3.45±0.75	3.28±0.85	0.522	2.30±0.82	3.28±0.91	0.001
Confusion	2.10±1.08	2.33±0.89	0.204	1.65±0.86	2.38±0.98	0.001
Aggression	2.00±0.93	2.15±0.89	0.395	1.60±0.84	2.30±0.97	0.001
Hopelessness	2.45±1.08	2.45±1.04	0.916	1.85±0.89	2.48±0.96	0.003

*The Mann-Whitney test.

of all PMS physical symptoms between the study and control groups in favor of the study group, except for breast tenderness and swelling, weight gain, headache, and increased appetite (Table 2).

Furthermore, a significant decrease in mean scores of the intensity of all premenstrual psychological symptoms was noted among the study and control groups in favor of the study group after 4 weeks of interventions, except for forgetfulness (Table 3).

There was no statistically significant difference between the study and control groups in mean intensity scores of all premenstrual behavioral symptoms. On the other hand, after the intervention, there was a statistically significant decrease in mean scores of the intensity of all premenstrual behavioral symptoms between the study and control groups in favor of the study group, except for clumsiness, poor judgment, obsessive and irrational thoughts (Table 4).

It was found that the intensity of PMS symptoms before intervention was moderate among the majority (80% and 82.5%) of the study and control groups, respectively, with no statistically significant difference between the two groups (P=0.775). Meanwhile, after the intervention, about one-third (35%) of the study group still suffered moderate-intensity PMS compared to about three-quarters (72.5%) of the control group. Consequently, the difference between the two groups was statistically significant (P=0.0001). In addition, the intensity of PMS symptoms among the study group was significantly decreased after the intervention (P=0.001). In contrast, the intensity of PMS symptoms among the control group was significantly increased after the intervention (P=0.034). Finally, the intensity of PMS symptoms became severe among 12.5% of the control group after intervention compared to none before intervention (Table 5).

Discussion

Upon investigating the effect of JPMRT on PMS, the current study revealed that the intensity of PMS physical symptoms significantly decreased after practicing JPMRT in the study group. Meanwhile, no difference was found between the control group after applying routine care. This result suggests a possible positive influence of JPMRT on decreasing the intensity of PMS physical symptoms. Dizziness and fatigue emerged as common PMS physical symptoms in the current study.

Table 4. Comparing premenstrual syndrome behavioral symptoms before and after the intervention

Behavioral Symptoms	Mean±SD		P*	Mean±SD		P*
	Before			After 4 weeks		
	Study (n=40)	Control (n=40)		Study (n=40)	Control (n=40)	
Social withdrawal	2.70±1.02	2.95±0.81	0.267	1.85±0.95	3.00±0.82	0.001
Restlessness	3.60±0.63	3.55±0.88	0.850	2.35±0.83	3.58±0.96	0.001
Lack of self-control	2.98±0.86	3.10±0.78	0.618	2.20±0.88	2.98±0.70	0.001
Feeling guilty	1.98±0.86	1.95±0.85	0.898	1.65±0.74	2.28±0.85	0.001
Clumsiness	1.58±0.68	1.70±0.72	0.439	1.55±0.68	1.83±0.81	0.131
Lack of interest in usual activities	2.58±0.87	2.48±0.85	0.563	2.08±0.83	2.58±0.75	0.002
Poor judgment	2.23±0.89	2.33±0.94	0.608	1.98±0.86	2.28±0.88	0.094
Impaired work performance	2.58±0.96	2.85±0.89	0.245	2.13±0.76	2.88±0.99	0.001
Obsessional thoughts	1.60±0.87	1.55±0.81	0.876	1.48±0.72	1.63±0.77	0.355
Compulsive behavior	1.43±0.75	1.53±0.75	0.411	1.10±0.30	1.68±0.83	0.001
Irrational thoughts	1.48±0.82	1.48±0.75	0.869	1.30±0.65	1.55±0.90	0.147
Being over-sensitive	2.80±1.34	2.80±1.20	0.856	1.85±0.86	2.98±1.23	0.001

*The Mann-Whitney test.

Both symptoms were significantly reduced in the study group after practicing JPMRT. These results may be attributed to the circulatory enhancement of PMRT, which is instrumental in improving such symptoms. In the study of Ferreira and Kulkarn, the relaxation technique was more effective in reducing the severity of fatigue and headaches in premenstrual syndrome in individuals compared to meditation with visualization [16].

The results of the present study also showed that after practicing PMRT, marked improvement was observed among the study group concerning pelvic discomfort and pain, abdominal cramps, generalized aches and pain, and muscle and joint pain. This result may be attributed to progressive relaxation enhancing pain relief by decreasing muscle tension, lowering anxiety levels, and distracting attention. Moreover, it improves pain relief by aligning with the gate control theory of pain. The theory postulates that changes in pain impulses transmitted from the peripheral nerve receptors to the brain can result in little or no pain perception [17]. The current

Table 5. Total Intensity scores of premenestral syndrome symptoms among students in two groups before and after the intervention

The Total Score of PMS Symptoms	No. (%)				P	
	Study (n=40)		Control (n=40)			
	Before	After	Before	After	Before	After
Mild symptoms (41-80)	8(20.00)	26(65.00)	7(17.50)	6(15.00)		
Moderate symptoms (81-120)	32(80.00)	14(35.00)	33(82.50)	29(72.50)	0.775	0.0001
Severe symptoms (121-160)	0(0)	0(0)	0(0)	5(12.50)		
Marginal homogeneity test	P=0.001		P=0.034			

*The chi-square test, **The Monte Carlo test.

study's findings were relatively similar to the results of Naik et al. They reported a highly significant reduction in post-test pain scores for those supplemented with Jacobson's relaxation technique on dysmenorrhea [18].

The present study observed that PMRT significantly decreased abdominal bloating, bizarre bowel habits, and nausea and vomiting symptoms among the study group after the intervention. According to the relevant literature, prostaglandins may provide a pathophysiological link to understanding the overlap between menstrual pain and gastrointestinal symptoms. Premenstrual uterine prostaglandin production may mediate an inflammatory response characterized by pain. So, during menses, abnormally high levels of prostaglandins in a menstrual fluid may induce abnormal uterine contractions and pain. In the gut, prostaglandins can cause smooth muscle contractions, reduced absorption, and induced secretion of electrolytes in the small bowel, all of which may lead to gastrointestinal pain and diarrhea [19]. Bernstein et al. reported that the occurrence of gastrointestinal symptoms in conjunction with the premenstrual and menses phases is common [20].

Furthermore, skin changes, rashes, and pimples significantly improved among the study group after practicing PMRT. This result agrees with the fact that PMRT decreases salivary cortisol and improves immune system functions, which justifies the improvement of these symptoms [21].

Regarding the effect of PMRT on PMS psychological symptoms, the result of the current study revealed a statistically significant decrease in the intensity of almost all PMS psychological symptoms among the study group after the intervention. In other words, progressive muscle relaxation positively affected PMS psychological symptoms. In this respect, Nasution et al. reported that this emotional response and the soothing effect generated by this relaxation transform the sympathetic dominant physiology into the dominant parasympathetic system. In these circumstances, the secretion of stress hormones such as cortisol and catecholamine (epinephrine and norepinephrine) decreased [22]. The present result is similar to the findings of other studies [23, 24].

The present study noted a statistically significant decrease in the intensity of most PMS behavioral symptoms among the study group after the intervention. This finding may be attributed to those premenstrual behavioral symptoms directly related to premenstrual psychological symptoms. In addition, this means that PMS behavioral symptoms may be triggered by the luteal phase psychological disturbance that results from serotonin deficiency. Consequently, improvement of psychological symptoms may significantly lead to behavioral symptoms improvement.

Regarding the total score of the intensity of PMS symptoms, the intensity of PMS symptoms in the study group was significantly decreased after the intervention. In contrast, the intensity of PMS symptoms in the control group significantly increased after routine care.

This result is incongruent with Sudhadevi et al. They concluded that PMRT exercises effectively reduced premenstrual syndrome symptoms among students [13].

Based on the results of the current study, the progressive muscle relaxation technique appears to have a remarkable effect on reducing the severity of PMS. Therefore, useful, beneficial impacts of non-pharmacological modalities such as PMRT on PMS should be included in curricula of university students in different educational settings, and training programs for nurses in maternity units about the utilization of non-pharmacological interventions such as PMRT in managing PMS are recommended.

This study was limited to students of Nursing School, at Damanhur University in Egypt and does not represent the whole female university student population in Egypt. Since the topic is sensitive to Egyptian culture, some respondents were reluctant to discuss their real personal problems.

Ethical Considerations

Compliance with ethical guidelines

The study was approved by the Ethics Committee of the School of Nursing, Alexandria University, for the period 2020- 2021. The researchers also secured permission to conduct the study from the responsible authorities of the study setting. Before implementing the interventions, the researchers approached eligible students and gave them a detailed description of the intervention, its benefits, and any possible risks. Researchers also ascertained that participation in the study is entirely voluntary, and the subjects could refuse to participate or withdraw from the study at any time. Confidentiality of the obtained data, students' anonymity, and privacy were assured. The study was conducted following the principles of the Declaration of Helsinki, seventh revision.

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Authors' contributions

Study design and manuscript writing the original draft : Naglaa Fathy Fathalla, Niven Rizk Mohmed and Hanan Moustafa Ashour; Data collection: Nemat Ismail Abdel Aziz; Data analysis: Naglaa Fathy Fathalla and Hanan Moustfa Ashour; Final Approval: All authors.

Conflict of interest

The authors declared no conflict of interest.

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