



Effect of Pilate's Exercises and WhatsApp based Support Program on Premenstrual Syndrome, Daily Activities and Academic Performance of Nursing Students

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ABSTRACT

Background: Premenstrual Syndrome is a prevalent issue characterized by symptoms that can adversely impact academic performance and everyday activities of affected students. Experts and women have become interested in moderate physical activity as Pilate's exercise as alternative treatment for premenstrual syndrome in recent years. **Aim:** The study aimed to examine the effectiveness of Pilate's exercises and WhatsApp based support program on premenstrual syndrome, daily activities and academic performance of nursing students. **Design:** A quasi-experimental research design was used (one-group, time series). **Study Setting:** The study was conducted in the Faculty of Nursing at Benha University in Qaliobya governorate, Egypt. **Sample:** A Purposive sample of 83 female nursing students was used. **Tools:** Four main tools were utilized: a structured self-administered questionnaire, Menstrual Distress Questionnaire (MDQ), Activity of Daily Living Scale (ADLS) and Academic Performance Scale. **Results:** Nursing students exhibited improved knowledge, decrease premenstrual syndrome, better daily activities and academic performance, with a high statistically significant difference among mean scores regarding all research variables at pre-intervention, 4 weeks and 8 weeks post-intervention phases. As well as, there was a highly statistical significant positive correlation between total PMS and total activities of daily living and academic performance of the studied students at pre- intervention, 4 and 8 weeks post- intervention phases. **Conclusion:** The implementation of Pilate's exercises and Whatsapp based support program were effective in relieving premenstrual syndrome, improved activities of daily living and academic performance of nursing students; so, the research hypothesis was accepted. **Recommendations:** Integrating Pilate's exercises as a complementary and alternative therapy within nursing practices and educational programs to alleviate primary dysmenorrhea in adolescent female students.

Keywords: Academic Performance, Daily Activities, Pilate's Exercises, Nursing Students, Premenstrual Syndrome, WhatsApp based Support Program.

Introduction

A clinical condition known as premenstrual syndrome (PMS) lasts for three consecutive cycles, starting five days before the onset of menstruation

and ending four days after. Premenstrual symptoms are very common and affect approximately half of women of childbearing age worldwide, the symptoms are repetitive and

sufficiently severe to interfere with normal daily activity, student achievement and psychomotor condition (*Geta, et al., 2020*). During the premenstrual phase of the menstrual cycle, PMS symptoms fall into three categories: mild, moderate, and severe. People with severe PMS will find it difficult to maintain their social and familial relationships, academic relationships, and regular daily activities. Thirty to fifty percent of women of childbearing age have mild to moderate symptoms, and three to eight percent have severe symptoms (*Chen, et al., 2023*).

The cause of premenstrual syndrome is unknown, due to the fact that PMS symptoms coincide with variations in the menstrual cycle, it has been suggested that there are hormonal imbalances, such as too much estrogen and not enough progesterone. Serotonin has been related to symptoms as a major etiological component. Nonetheless, it is thought that dietary and lifestyle choices including smoking, drinking alcohol, using caffeine, and getting too much sleep are linked to PMS (*Turan, et al., 2024*).

A reaffirmed cluster of psychological as well as physical signs experienced during the luteal phase of the menstrual cycle is also known as premenstrual syndrome. In the five days preceding menstruation, premenstrual syndrome is characterized by the presence of at least one somatic symptom (such as abdominal bloating, breast tenderness, headaches, or swelling of the extremities) and at least one affective symptom (such as irritability, anxiety, confusion, depression,

angry outburst, or social withdrawal) (*Bilir, et al., 2020*).

Premenstrual syndromes are common, impacting around 50% of reproductive-age women globally. The majority of women who experience symptoms are between the ages of 25 and 35, though they may show up at any point, from adolescents to menopause. However, prevalence rates vary significantly between studies and nations based on participant characteristics, how they live, personal attitudes and stressors (*Itriyeva, 2022*). Students with PMS have lifelong challenges since it diverts them from their professional, academic and interpersonal interactions (*Nam and Cha, 2020*).

Premenstrual syndromes have a significant negative impact on female students' mental health (e.g., labile mood), cognitive abilities (e.g., concentration), and academic performance (e.g., increased absenteeism). This results in a 30% decrease in the students' overall academic performance. PMS reduces students' productivity and efficiency; examples include problems concentrating (60.4%), homework (48.9%), social activities (19.45%), and interactions with friends and family (19.1%). Poorer academic performance may make university students feel more psychologically stressed, which could make PMS symptoms worse (*Shehadeh, et al., 2018*).

Different studies have suggested that PMS can be treated with medicine (such as antidepressants, oral contraceptives, vitamin B6), surgery (ovaries removed), and alternative non-

pharmacological treatments (such as exercise, dietary changes, cognitive-behavioral therapy and supportive educational program) (*El Hajj, et al., 2020*).

Social media is now a potent instrument for enhancing health equity for all individuals, even those from low- and middle-income nations. Among the social media networks, there is an app that over 700 million people use globally that lets smartphone user's share content with each other, including text messages and videos. With WhatsApp, numerous users can form groups, join chats simultaneously, and follow anything shared within the groups at the same time (*Yarımkaaya, et al., 2022*).

The effects of WhatsApp support and internet-based therapy on the symptoms of PMS were demonstrated because the impact of encouragement through the social media on premenstrual syndrome information may now be easily obtained because to advancements in communication science and the media, and when used appropriately, it can solve a variety of PMS related issues (*Davari, et al., 2023*).

All the body's capacities and functions benefit from physical activity and exercise. Pilate's exercises are particularly beneficial to psychological health (better mood, increased motivation, and body awareness), motor functions (muscle control, dynamic postural control, balance, and coordination), and physical health (muscle strength, endurance, stabilization in core muscles, strengthening in respiratory muscles) which is particularly popular with women worldwide.

Pilate's incorporates the following principles: breath, centering, precision, harmony and whole-body movement (*Hassan, et al., 2022*).

Pilate's exercises is typically recommended by doctors as a means of reducing premenstrual syndrome symptoms. Many women have turned to Pilate's as a non-pharmacological, affordable, readily applicable, and easily learned skill through available YouTube videos. It also has no negative effects and doesn't require a prescription. So Pilate's exercise has several advantages beyond menstrual health and can be a useful, non-pharmacological treatment option for PMS (*Sanchez, et al., 2023*).

Significance of the study:

In Egypt, the limited data on PMS prevalence are collected from small groups of students or nurses, which can't be generalized to the population. For example, the prevalence is estimated to be 51.5% among 800 secondary school girls (*Abdelmoty, et al., 2015*). Prevalence is also reported in individual governorates as (56.1%) among 285 teenage female students at Zagazig University (*Nooh, et al., 2016*) and (86.3%) among 4122 girls (12–25 years) representing Beni-Suef City (*Arafa, et al., 2018*).

Because premenstrual syndrome negatively impacts a young woman's self-esteem, social interactions, attendance at school, everyday activities, financial situation, academic success, and quality of life, it is also a significant health issue for young women that needs to be addressed in its early stages. (*Abbas, et al., 2020*). It was also

observed that the impact of Pilate's exercises and what's-App supportive programs on the degree of PMS, daily activities, and academic achievement of nursing students had not been extensively researched in many studies. This study may therefore imply future research on this topic

Aim:

The study aimed to examine the effectiveness of Pilate's exercise and WhatsApp based support program on premenstrual syndrome, daily activities and academic performance of nursing students.

Hypothesis:

The nursing students will exhibit improved knowledge, relieved premenstrual syndrome, better daily activities and academic performance after implementation of Pilate's exercise and whatsapp based support program than before.

Operational definition:

Pilate's Exercises: consists of five minutes of warm-up exercises, thirty minutes of basic Pilate exercises, and a final five to seven minutes of cooling down. One to three sets of eight to twelve repetitions each were done with each session, with the number of repetitions increasing gradually.

WhatsApp Based Support Program: is a messaging service that enables users to send instant messages to connections, including positive messages about Pilate's exercises and generic information about PMS.

Conceptual definition

Daily Activities: refers to all of the basic abilities needed to take care of oneself on one's own, including eating, cleaning, and moving. Sidney Katz originally used the term "activities of daily living" in 1950.

Academic Performance: is the evaluation of student's performance in a range of academic courses. Typically, graduation rates, test scores, and classroom performance are used by educators to gauge student achievement.

Subjects and method

Research Design:

For this study (one-group, time series) quasi-experimental design was chosen as the research methodology. "The term quasi experimental design refers to a type of research design that lacks the element of random assignment," state (*Vegetti, 2022*).

Study Setting:

The study was conducted in the Faculty of Nursing at Benha University. The faculty of Nursing consists of six different departments: medical and Surgical Nursing, Community Health Nursing, Nursing Administration, Obstetric and Gynecological Nursing, Psychiatric and Mental Health Nursing and Pediatric Nursing department. The faculty serves students (males and females) and postgraduate students from all Qalubia and other governorates.

Sampling:

Sample size, type and criteria: A Purposive sample of 83 female nursing students. Total

number of nursing students enrolled in first academic year 2023/2024 (to avoid bias as they don't study pain relief measurement and obstetric and gynecological nursing.) was (1193); (361) Male and (832) Female. Ten percent of female nursing students (83 female students) were chosen according to the following inclusion criteria: Female nursing students, who suffer from PMS, not take any medication or sedatives, mineral or vitamin supplements and herbals during the last three menstrual cycles, lack of regular exercise during the past three months, and free from chronic and psychological diseases. Exclusion criteria: surgery during the last 6 months.

Tools of data collection:

Four tools were used for data collection:

Tool I: A structured self-administered questionnaire: that was translated into Arabic after created by researchers following a review of relevant literature. There were three parts.

Part: (1): Personal characteristics of nursing students: it comprised of 4 items which were (age, residence, marital status and family income).

Part (2): Menstrual history of nursing students: It included 5 items (age at menarche, duration of menstrual flow, amount of blood flow, frequency of menstrual cycle and regulation of menstruation).

Part (3): Students' knowledge regarding PMS questionnaire: It was developed by researchers after reviewing a related literature (*Abdalla and Gibreel, 2016*), (*Mahdi and Khairi,*

2020) and (*Abdalla et al., 2023*) to assess students' knowledge regarding PMS. All asked questions were in the form of MCQ questions. It consisted of (10 questions) such as (definition of PMS, causes, duration, emotional symptoms, behavioral symptoms, physical symptoms of PMS, diagnosis, effect of PMS on life activities, effect of PMS on academic performance and self-care practices to relieve PMS).

Scoring system :Each multiple-choice question's weight was determined by the answers that were provided. For every item, a score of (1) was assigned for the correct answer, a score of (0) for the wrong response, or a score of don't know. The sum of the points for each item was used to determine the final score.

Total knowledge score was classified as the following:

Parameter	Score
Adequate knowledge	75% to 100%
Inadequate knowledge	less than 75%

Tool II: Menstrual Distress Questionnaire (MDQ): It was adopted from (*Cassioli et al., 2023*) and (*Ross et al., 2003*). It is a 46-item self-reporting questionnaire used in the assessment, follow-up, and treatment of premenstrual and menstrual symptoms. It detects the type and severity of premenstrual symptoms. Also, this questionnaire is used by researchers and clinicians to help detect the effects of therapeutic interventions. It was divided into 8 sub-scales: {pain (6 items), concentration (8 items), water retention (4 items), behavior change (5 items), negative affect (8 items), autonomic reactions (4

items), arousal (5 items), and control (6 items).As the shown in the following table:

Pain	Concentration	Water retention	Behavioral changes
1. Muscle stiffness 2. Headache 3. Cramps 4. Backache 5. Fatigue 6. General aches and pains	1. Insomnia 2. Forgetfulness 3. Confusion 4. Lowered judgment 5. Difficulty concentrating 6. Distractible 7. Accidents 8. Lowered motor coordination	1.Weight gain 2. Skin disorders 3. Painful breasts 4.Swelling	1. Lowered school or work performance 2. Take naps; stay in bed 3. Stay at home 4. Avoid social activities 5. Decreased efficiency
Negative effect	Autonomic reactions	Arousal	Control
1. Crying 2. Loneliness 3. Anxiety 4. Restlessness 5. Irritability 6. Mood swings 7. Depression 8. Tension	1. Dizziness, faintness 2. Cold sweats 3. Nausea, vomiting 4. Hot flashes	1. Affectionate 2. Orderliness 3. Excitement 4. Feelings of well-being 5. Bursts of energy, activity	1. Feeling of suffocation 2. Chest pains 3. Ringing in the ears 4. Heart pounding. 5. Numbness, tingling 6. Blind spots, fuzzy vision.

Scoring system:

The students were instructed to rank the symptoms from 1 ("no experience of the symptom") to 6 ("acute or partially disabling symptoms") and it was done for the most recent menstrual cycle. The total score ranged from 46 to 276, with higher scores indicating more severe PMS. The score for overall PMS is obtained by calculating a mean of the students' responses to all 46 items; eight subscale scores are obtained similarly by calculating a mean of the responses to subscale items. *Students' severity of PMS was categorized as follow:*

Parameter	Score
No symptoms of PMS	≤ 46
Mild symptoms of PMS	From 47 to 122
Moderate symptoms of PMS	From 123 to 199
Severe symptoms of PMS	From 200 to 276

Tool III: Activity of Daily Living Scale

(ADLS): It was adapted from (*Pashmdarfard and Azad, 2020*) and (*Baby and Kunde, 2022*). It is a 12 item self-reported tool used to measure functional status and activities of daily living or tasks that all students do to live an independent life as work efficiency and productivity, personal care and hygiene and home responsibility. The researchers made many modifications, deleting some items and adding others to suit the tasks and activities that students practice daily, and thus the scale became more appropriate.

Scoring System:

Total activity of daily living score was classified as the following:

The score of each item ranged from 0 (maximum disability and dependency) to 8 (maximum strength and independence). The total

score ranged from 0 to 96, with a high score indicating better function and activity. Students' daily living score was categorized as follows:

Parameter	Score
Acceptable level	60% to 100%
Non-acceptable level	less than 60%

Tool IV: Academic Performance Scale: It was adopted from (Birchmeier, 2022). It is 8 item questionnaire used to reflect what subjects do or have done as students. The students were instructed to be as honest as possible because the information can be utilized to discover areas of weakness and strength in their academic performance.

Scoring System:

To score the scale, each question used the 5-likert point scale. "Strongly Agree" is scored (5); "Agree" is scored (4); "Neutral" is scored (3); "Disagree" is scored (2); and "Strongly Disagree"

is scored (1). The total score ranged from 8 to 40, with a high score indicating better performance. *Total performance score was classified as the following:*

Parameter	Score
Excellent Performance	33 – 40
Good Performance	25 – 32
Moderate Performance	17 – 24

Tools validity: Three jury experts from Benha University who specialize in obstetrics and gynecological nursing assessed the validity of the questionnaires to make sure the instruments were applicable, clear, relevant and complete. A few sentences needed to be rewritten or added, among other minor changes. The tools were regarded as legitimate by the experts.

Tools reliability: The reliability of tools was done by Cronbach's Alpha coefficient test, which revealed that the internal consistency of research tools as following:

Tool	Cronbach's alpha value
Tool I "part 3": Students' knowledge questionnaire.	Internal consistency ($\alpha=0.85$).
Tool II: Menstrual Distress Questionnaire (MDQ).	Internal consistency ($\alpha=0.84$).
Tool III: Activity of Daily Living Scale (ADLS).	Internal consistency ($\alpha=0.989$).
Tool IV: Academic Performance Scale.	Internal consistency ($\alpha=0.89$).

Ethical consideration: Before the study began, several ethical factors were taken into account, such as the following: The scientific research ethics committee at Benha University's faculty of nursing approved the study in order for it to proceed. The ethical code number REC-OBSN P3G. To complete the study, formal consent was sought from the chosen study locations.

To earn the trust and confidence of the students, the researchers gave an explanation of the purpose and significance of the study prior to using the instruments. Students gave the researchers their formal agreement to participate in the study, and confidentiality was guaranteed. The students faced no dangers, either psychological, social, or physical, from the research. After statistical analysis, all data collecting instruments were

destroyed to protect the participants' privacy. The research instruments made sure the study didn't incorporate any depraved remarks and upheld human rights. The pupils might stop studying at any moment.

Pilot study:

A pilot study comprising 8 students, or 10% of the total sample size, was carried out to assess the objectivity, clarity, feasibility, and applicability of the tools. It also aimed to identify potential challenges and issues that could arise for the researchers and impede data collection, as well as any issues unique to the statements as a series of questions and clarity. Estimating the amount of time needed to collect the data was also helpful. To prevent sample contamination, the pilot sample was removed from the research and modifications were made based on the pilot results.

Field work:

The following stages were used to achieve the study's objectives: planning, implementing Pilate's exercises, conducting interviews and assessments, conducting an evaluation phase. From the start of October 2023 to the conclusion of March 2024, a total of six months were spent conducting these stages. Taking into account the students' free time outside of their academic schedule, the researchers met with the students three times a week (on Sundays, Mondays, and Tuesdays) from 9 a.m. to 3 p.m.

Preparatory phase:

In this stage of the study involved an evaluation of relevant local and international literature review to the research subject by the

researchers. This directed the researchers in preparing the necessary data gathering tools and helped them understand the scope and gravity of the issue. The purpose of distributing the tools to three obstetrics and gynecological nursing specialists at Benha University's Faculty of Nursing was to assess their suitability, comprehensiveness, clarity, relevance, and application. The jury's verdicts were completed.

Interviewing and assessment phase:

During this phase, students were interviewed in the faculty of nursing lecture hall at Benha University in order to gather personal data. The researchers met each student and went over the purposes, schedule, and activities of the study at the start of the interview. In order to evaluate students' personal traits, menstrual histories, and understanding of PMS, the researchers gave them the structured self-administered questionnaire (Tool I).

The researchers then gave out the Menstrual Distress Questionnaire (Tool II) (pre-test), the Activity of Daily Living Scale (Tool III) (pre-test), and the Academic Performance Scale (Tool IV) (pre-test) to determine how severe their PMS was. The information gathered in this stage served as the benchmark for subsequent analyses to assess the impact of Pilate's exercise and the Whatsapp based support program. After using all of the tools, it took an average of 25 to 30 minutes.

Before beginning Pilate's exercises with tools seven days before to menstruation, students completed a pretest evaluation. In this stage, researchers begin to ascertain each student's

unique educational needs, which aids in the planning stage. A WhatsApp group was established with the students' phone numbers to help with communication during and after classes.

Planning phase:

The results of the assessment phase were used by the researchers to create a printed guidance booklet with colorful illustrations. The researchers created the booklet using basic Arabic language and various illustrated pictures to satisfy the studied students' lack of knowledge regarding PMS and to demonstrate the phases and procedures of implementing Pilate's exercises. This was done after they conducted a thorough and pertinent literature review. For the students, the researchers produced a video demonstration on how to perform the Pilate's movements.

The number of sessions and their contents, the various teaching modalities, and the educational media were decided. Goals were designed to be accomplished following the conclusion of the Whatsapp based support program. The overarching goal of the educational and intervention program was for each student to graduate with the necessary skills, reduce PMS symptoms, improve their everyday functioning, and do better academically.

Implementation phase

A variety of instructional techniques and materials were employed, such as PowerPoint presentations, video films, role-playing, altered lectures, group discussions, and role-playing. To clear up any misunderstandings, questions from female students were handled at the conclusion of

each class. Feedback about the previous session and the new session's goals were discussed at the beginning of the following session.

Theoretical session: The session covered detailed information about PMS, including its definition, causes, duration, emotional symptoms, behavioral symptoms, physical symptoms of PMS, diagnosis, effect of PMS on life activities, effect of PMS on academic performance and self-care practices to relieve PMS. The average duration of this session lasted (45-60 minutes).

Practical sessions: The 24 sessions of the Pilate's integrated exercise program were held for each topic over the course of eight weeks, three sessions each week. The length of each session was chosen to align with current research showing that lengthier programs (24 sessions, each lasting an average of 30 to 45 minutes) yield superior outcomes (**Giacomini et al., 2016; Kloubec, 2011**). To help with proper placement and movement, verbal and visual instructions were used to show and re-demonstrate each task this session were conducted in closed room dedicated to student's locker.

- The students were instructed to wear comfortable clothes. Each exercise would be performed for ten repetitions each session and the contraction would be maintained for five seconds followed by ten seconds of relaxation.
- Each session in the Pilate's exercises program conducted through three phases (1st phase (Warm-up), 2nd phase (basic Pilate's exercises)

and 3rd phase (cool-down) in the presence of the researchers.

- During the first phase, warm-up exercises such as head motions, standing roll downs, and arm alternating were performed for five minutes.
- 2nd phase included 30 minutes of basic Pilate's exercises designed to relax and strengthen the back, abdominal, and pelvic muscles; including single leg lifts, alternate leg lifts, leg circles, single and double leg stretches, spine stretch forward, and pelvic rocking as presented in *Figure 1*.
- 3rd phase included cooling down for the last 5 - 7 min (movements in sitting and lying down

position to return to the initial state) (*Giacomini et al., 2016; Kliziene et al., 2017*).

- Every exercise involved practicing breath control. These exercises were chosen from the original repertory of Pilate's exercises due to their ease of delivery and no equipment requirements.
- A special WhatsApp group was created for students participating in the study to send educational materials and videos explaining how to practice Pilate's exercises and to remind them of their times, which leads to better support for the program by constantly reminding them.



Figure (1): Pilate's exercise (*Song and Kim, 2023*).

Evaluation phase:

The nursing students were evaluated 4 weeks and 8 weeks after implementing Pilate's exercises and a Whatsapp based support program. The nursing students' knowledge regarding PMS, PMS severity, activities of daily living and academic

performance were evaluated used Pre-posttest tools (Tool I – Part 3, II, III, and IV).

Statistical analysis:

The data were verified prior to computerized entry. The collected data was organized, coded, computerized and analyzed using appropriate

statistical methods and tests. The Statistical Package for Social Sciences (SPSS version 22.0) was used. Descriptive statistics included frequencies and percentages, means, and standard deviations.

The study hypothesis was tested using inferential statistics, namely the Friedman test and the ANOVA test. To look at the link between the scores of various research variables, the correlation coefficient was employed. A p -value > 0.05 showed no statistically significant difference, a p -value < 0.05 indicated a statistically significant difference, and a p -value $P = 0.001$ indicated a highly statistically significant difference for all of the statistical tests that were conducted.

Results:

Table (1): Shows that 68.7% of studied nursing students were in age group 18- years old with a mean age of 18.08 ± 0.64 years. Concerning the residence, 60.2% of them lived in rural areas. Furthermore, 94.0% were single. Pertaining to family income 83.1% of them didn't have enough income.

Table (2): Reveals that, 59.0% of nursing students had their menarche at the age group of 12-13 years old and that the duration of menstrual flow for 65.1% of the students ranged from 3 to 7 days. The amount of blood flow for 79.5% of students was 2–4 pads/day and the frequency of the menstrual cycle for 89.2% of them was 21–35 days. Finally, 80.7% of them showed regular menstrual cycle.

Table (3): demonstrates that there was a highly statistical significant difference between the results of 4 and 8 Weeks post program implementation compared to pre-intervention phase in favor of 8 Weeks post-intervention regarding all items of nursing students' knowledge about premenstrual syndrome ($p \leq 0.001$).

Figure (1): Shows that, 39.8% of nursing students had adequate knowledge and 60.2% of them had inadequate knowledge regarding premenstrual syndrome at pre-intervention phase compared to 81.9% and 18.1% at 4 weeks post-intervention and 84.3% and 15.7% at 8 weeks post-intervention respectively.

Table (4): Indicates that, there was a high statistically significant difference among mean scores regarding nursing students' premenstrual syndrome subscales at pre-intervention, 4 weeks post-intervention, and 8 weeks post-intervention phases p -value < 0.001 . The total mean score of premenstrual syndrome of studied nursing students decreased from 129.81 ± 10.74 to 101.45 ± 9.35 and 94.83 ± 8.74 throughout the study phases, in favor of 8 weeks post- intervention phase.

Table (5): Indicates that there was a high statistically significant difference among mean scores of studied nursing students' activities of daily living affected by PMS at pre-intervention, 4 weeks post-intervention and 8 weeks post-intervention phases with p - value < 0.001 . The total mean score of activities of daily living of studied students was improved from 65.08 ± 4.87 to 73.40 ± 5.09 and 77.56 ± 5.44 throughout study

phases; in the favor of 8 weeks post- intervention phase.

Figure (3): Shows that 57.8%, 78.3% and 80.7% of studied nursing students had acceptable level of activities of daily living at pre-intervention, 4 weeks and 8 weeks post-intervention phases respectively.

Table (6): Indicates that there was a high statistically significant difference among mean scores of studied nursing students' academic performance affected by PMS at pre-intervention, 4 weeks post-intervention and 8 weeks post-intervention phases with p- value<0.001. The total mean score of academic performance of studied nursing students was improved from 25.46 ± 2.55 to 30.51 ± 3.22 and 32.34 ± 3.39 throughout study

phases; in the favor of 8 weeks post- intervention phase.

Figure (4): Shows that 37.3%, 55.4% and 56.6% of studied nursing students had good level of academic performance at pre-intervention, 4 weeks and 8 weeks post- intervention phases respectively. Also 19.3%, 24.1% and 25.3% of them had good level of academic performance at pre-intervention, 4 weeks and 8 weeks post-intervention phases respectively

Table (8): clarifies that there was a highly statistical significant positive correlation between total PMS score and total scores of (activities of daily living and academic performance) of the studied nursing students at pre- intervention, 4 and 8 weeks post- intervention phases ($P \leq 0.001$).

Table (1): Distribution of the studied nursing students' according to their personal characteristics (n. = 83)

Personal characteristics	No.	%
Age (in years):		
17-	11	13.2
18-	57	68.7
19-	15	18.1
Min. – Max.	17.0 – 20.0	
Mean \pm SD =	18.08 \pm 0.64	
Residence:		
Rural	50	60.2
Urban	33	39.8
Marital status:		
Single	78	94.0
Married	5	6.0
Family income:		
Enough	14	16.9
Not enough	69	83.1

Table (2): Distribution of the studied female nursing students according to menstrual history (n. =83)

Menstrual history	No.	%
Age at Menarche		
<12 years	14	16.9
12-13 years	49	59.0
>13 years	20	24.1
Duration of menstrual flow		
< 3 days	17	20.5
3-7 days	54	65.1
>7 days	12	14.4
Amount of blood flow		
1 pad/day	4	4.8
2-4 pads/day	66	79.5
≥ 5 pads/day	13	15.7
Frequency of menstrual cycle		
< 21 days	2	2.4
21-35 days	74	89.2
>35 days	7	8.4
Regulation of menstruation		
Regular	67	80.7
Irregular	16	19.3

Table (3): Compare of the studied nursing students' knowledge regarding premenstrual syndrome at pre-intervention, 4 weeks and 8 weeks post- intervention phases (n.=83).

Knowledge Items	Before intervention		4 Weeks Post intervention		8 Weeks Post intervention		Friedman test	
	Correct answer		Correct answer		Correct answer		X2	(P-value)
	No.	%	No.	%	No.	%		
Definition of PMS	39	47.0	73	88.0	75	90.4	68.22	0.000**
Causes of PMS	19	22.9	60	72.3	62	74.7	82.18	0.000**
Duration of PMS	25	30.1	65	78.3	66	79.5	80.04	0.000**
Emotional symptoms of PMS	34	41.0	68	81.9	71	85.5	68.48	0.000**
Behavioral symptoms of PMS	31	37.3	68	81.9	70	84.3	74.20	0.000**
Physical symptoms of PMS	42	50.6	70	84.3	78	94.0	59.55	0.000**
Diagnosis of PMS	27	32.5	62	74.7	65	78.3	70.47	0.000**
Effect of PMS on life activities	49	59.0	72	86.7	76	91.6	49.26	0.000**
Effect of PMS on academic performance	52	62.7	78	94.0	80	96.4	52.28	0.000**
Self-care practices to relieve PMS	24	28.9	54	65.1	61	73.5	62.64	0.000**

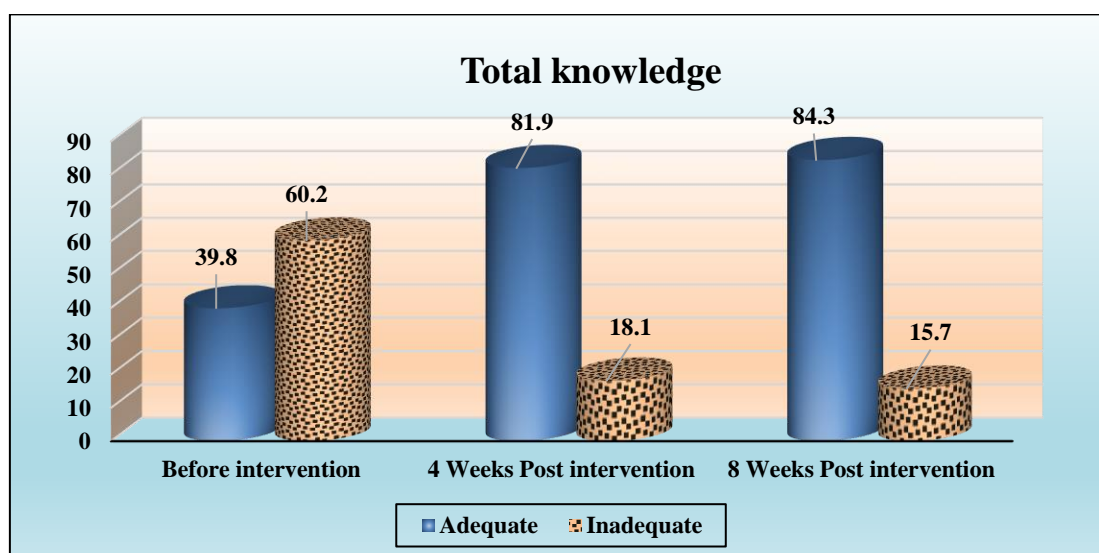


Figure (1): Distribution of nursing students regarding their total knowledge level about premenstrual syndrome at pre- intervention, 4 weeks and 8 weeks post- intervention phases (n.=83).

Table (4): Mean scores of premenstrual syndrome among nursing students at the pre-intervention, 4-week, and 8-week post-intervention phases (n = 83).

Menstrual Distress Questionnaire (MDQ) Subscales	Min./Max. score	Before intervention	4 Weeks Post intervention	8 Weeks Post intervention	ANOVA	
		Mean \pm SD	Mean \pm SD	Mean \pm SD	F	p-value
Pain	6/36	14.39 \pm 3.97	11.76 \pm 3.23	11.23 \pm 2.90	20.53	0.000**
Concentration	8/48	22.45 \pm 6.25	17.78 \pm 5.38	16.24 \pm 4.94	28.06	0.000**
Behavioral changes	5/30	15.67 \pm 4.21	11.92 \pm 3.39	10.51 \pm 2.90	47.15	0.000**
Autonomic reactions	4/24	14.18 \pm 3.73	10.65 \pm 2.97	9.89 \pm 2.50	44.77	0.000**
Water retention	4/24	9.63 \pm 3.23	7.43 \pm 2.54	6.84 \pm 2.54	22.85	0.000**
Negative effect	8/48	24.18 \pm 6.77	18.22 \pm 4.54	17.6 \pm 4.48	37.39	0.000**
Arousal	5/30	14.52 \pm 3.51	11.80 \pm 2.89	11.23 \pm 2.57	28.12	0.000**
Control	6/36	14.81 \pm 4.64	11.90 \pm 3.25	11.20 \pm 2.70	23.00	0.000**
Total score	46/276	129.81 \pm 10.74	101.45 \pm 9.35	94.83 \pm 8.74	307.66	0.000**

*A Statistical significant $p \leq 0.0$ **A Highly Statistical significant $p \leq 0.001$

Figure (2): Distribution of nursing students regarding their total level of premenstrual syndrome at pre-intervention, 4 weeks and 8 weeks post- intervention phases (n.=83).

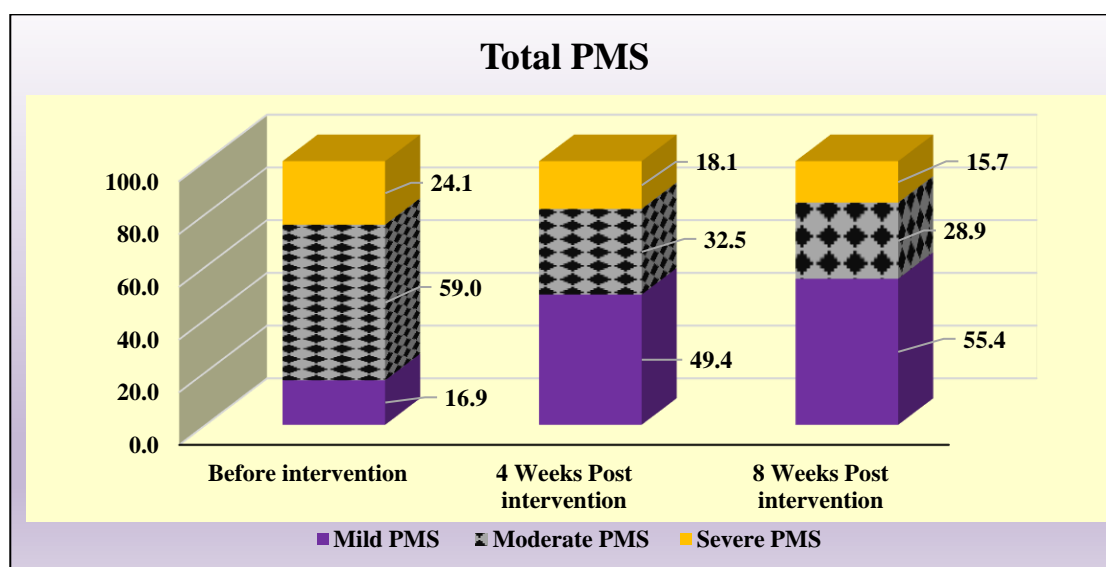


Figure (2): Displays that 16.9%, 49.4% and 55.4% of studied nursing students had mild PMS at pre-intervention, 4 weeks and 8 weeks post- intervention phases respectively

Table (5): Mean scores of studied nursing students' activities of daily living affected by PMS at pre-intervention, 4 weeks post-intervention and 8 weeks post- intervention phases (n.=83).

Activity of Daily Living	Min./Max. score	Before intervention	4 Weeks Post intervention	8 Weeks Post intervention	ANOVA	
		Mean \pm SD	Mean \pm SD	Mean \pm SD	F	p-value
Work efficiency or productivity	0/8	5.37 \pm 1.43	6.24 \pm 1.38	7.00 \pm 1.20	30.41	0.000**
Personal Care and hygiene		6.43 \pm 0.75	7.24 \pm 0.70	7.59 \pm 0.58	62.13	0.000**
Home responsibilities		4.39 \pm 1.27	5.10 \pm 1.29	5.46 \pm 1.15	16.01	0.000**
Relationships with coworkers		6.96 \pm 0.86	7.43 \pm 0.68	7.65 \pm 0.57	19.94	0.000**
Relationships with family		6.28 \pm 1.21	6.78 \pm 1.13	7.08 \pm 0.97	11.13	0.000**
Walking / Climbing Stairs		5.57 \pm 1.02	6.33 \pm 0.91	6.59 \pm 1.03	23.77	0.000**
Lite exercises		4.76 \pm 0.99	5.66 \pm 1.10	5.93 \pm 1.26	24.46	0.000**
Practicing hobbies		4.34 \pm 1.34	5.05 \pm 1.45	5.40 \pm 1.59	11.24	0.000**
Care of others		3.43 \pm 1.02	4.20 \pm 0.93	4.77 \pm 1.05	37.01	0.000**
Activities in the community		4.48 \pm 0.87	5.24 \pm 0.83	5.57 \pm 0.97	31.88	0.000**
Running Appointments		6.40 \pm 0.98	7.00 \pm 1.09	7.25 \pm 1.03	14.84	0.000**
Using Phone/Technology		6.67 \pm 0.85	7.13 \pm 0.99	7.28 \pm 0.94	9.41	0.000**
Total score	0/96	65.08\pm4.87	73.40\pm5.09	77.56\pm5.44	126.68	0.000**

*A Statistical significant $p \leq 0.0$

**A Highly Statistical significant $p \leq 0.001$

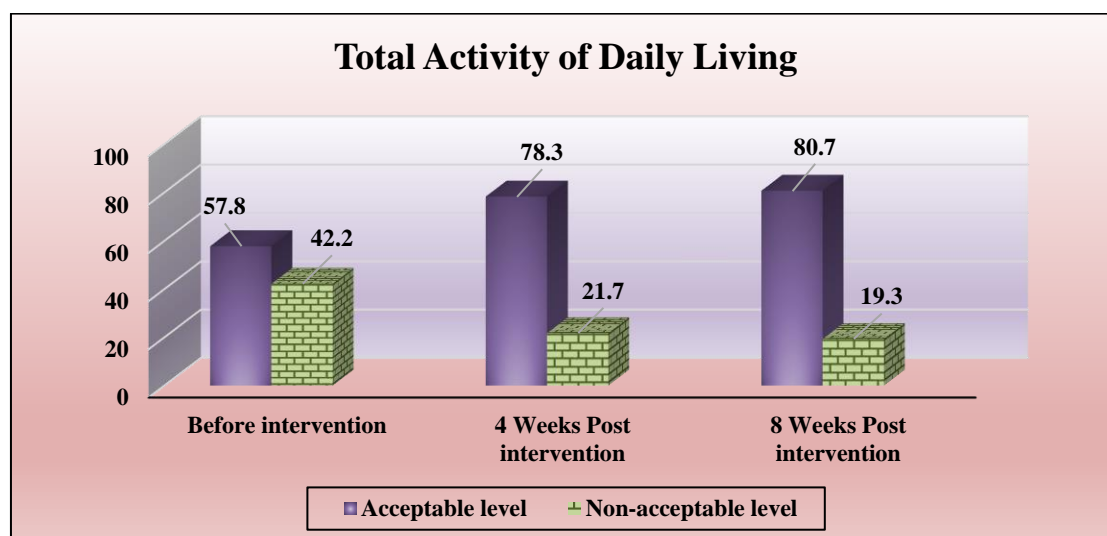


Figure (3): Distribution of nursing students regarding their total activities of daily living at pre- intervention, 4 weeks and 8 weeks post- intervention phases (n.=83).

Table (6): Mean scores of studied nursing students' according to their academic performance affected by PMS at pre- intervention, 4 weeks post-intervention and 8 weeks post- intervention phases (n.=83).

Academic Performance	Min./ Max. score	Before intervention	4 Weeks Post intervention	8 Weeks Post intervention	ANOVA	
		Mean \pm SD	Mean \pm SD	Mean \pm SD	F	p-value
Readiness in all my subjects.	1/5	3.40 \pm 0.79	4.01 \pm 0.83	4.27 \pm 0.82	24.62	0.000**
Paying attention and listen during every discussion.		3.58 \pm 0.81	4.14 \pm 0.79	4.35 \pm 0.86	19.46	0.000**
Getting good grades in every subject.		3.78 \pm 1.22	4.22 \pm 0.92	4.42 \pm 0.85	8.59	0.000**
Actively participate in every discussion.		2.96 \pm 0.81	3.83 \pm 0.82	4.08 \pm 0.81	42.74	0.000**
Starting papers and projects as soon as they are assigned.		2.86 \pm 1.10	3.39 \pm 1.19	3.64 \pm 1.03	10.69	0.000**
Enjoying homework and activities because they help me improve my skills in every subject.		3.07 \pm 0.80	3.78 \pm 0.95	4.04 \pm 0.95	25.17	0.000**
Exerting more effort when I do difficult assignments.		3.25 \pm 0.69	3.92 \pm 0.76	4.17 \pm 0.85	30.90	0.000**
Solving problems is a useful hobby for me.		2.57 \pm 0.85	3.23 \pm 1.02	3.39 \pm 1.06	16.04	0.000**
Total score	8/40	25.46\pm2.55	30.51\pm3.22	32.34\pm3.39	111.32	0.000**

*A Statistical significant $p \leq 0.0$

**A Highly Statistical significant $p \leq 0.001$

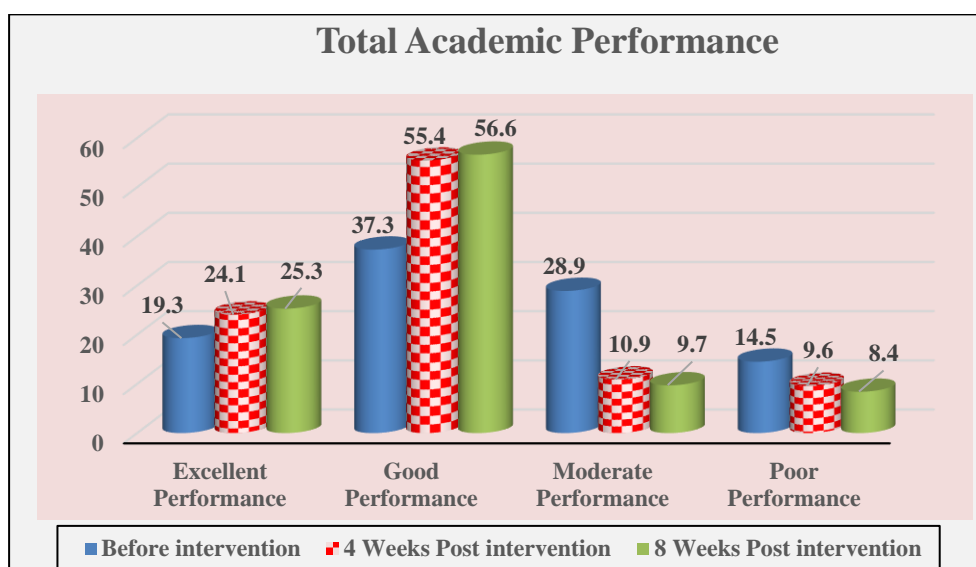


Figure (4): Distribution of nursing students regarding their total academic performance score at pre-intervention, 4 weeks and 8 weeks post- intervention phases (n.=83).

Table (7): Correlation between total PMS score and total scores of (activities of daily living and academic performance) of the nursing students at pre- intervention, 4 and 8 weeks post- intervention phases (n=83).

Variables	Total PMS					
	Before intervention		4 Weeks Post intervention		8 Weeks Post intervention	
	r	P-value	r	P-value	r	P-value
Total activities of daily living	0.456	0.000**	0.528	0.000**	0.519	0.000**
Total academic performance	0.357	0.000**	0.537	0.000**	0.408	0.000**

**A Highly Statistical significant $p \leq 0.001$

Discussion

Premenstrual syndrome, a common ailment among women in their reproductive years, is a group of behavioral, physical, emotional and cognitive symptoms that develop during the luteal phase of the menstrual cycle and promptly resolve with the onset of menstruation. Many symptoms and poor academic performance are associated with PMS, which is thought to alter woman's comfort level when executing daily tasks (Gürkan, and Bilgili, 2022).

The aim of the present research was to examine the effect of Pilate's exercise and a Whatsapp based support program on premenstrual syndrome, activity of daily living and academic performance of nursing students. The present study discussed under the following sections: nursing students' personal characteristics, menstrual history, knowledge regarding premenstrual syndrome, mean scores of studied nursing students' premenstrual syndrome, activities of daily living,

academic performance and correlation between total PMS score and total scores of activities of daily living and academic performance. Additionally, the research hypothesis was accepted, as there was a high statistically significant improvement in the scores regarding all research variables at pre-intervention, 4 months and 8 months post-intervention phases (p -value <0.001).

Regarding personal characteristics, current research revealed that more than two-thirds of studied nursing students were in the age group of 18–years old, with a mean age of 18.08 ± 0.64 years. Concerning residence, less than two-thirds of them lived in rural areas. Furthermore, the majority of them were single. Pertaining to family income, the majority of them didn't have enough income. These results were in same line with *Soliman, et al., (2022)* who showed that, regarding the socio-demographic distribution of the female nursing students under study, less than two-thirds of nursing students were younger than 20 years old. Their ages were 18.92 ± 1.04 years, with a range of 18 to 21 years old. The majority of them were from rural areas, most of them were single and the majority of them had inadequate incomes for their families. This reflected the same demographic characteristics as both studies carried out in Egypt. This could be explained as PMS were more relevant among early reproductive-age females, rural residents, and low social class, as that results in decreased awareness about PMS and delayed their requests for medical help.

Increasingly *Badkur, et al., (2023)* revealed that Majority of participants, were between the ages of 18 and 19 years, and the mean (\pm SD) age of study participants was 19 ± 1.48 years, three quarters of participants were permanent residents of rural area, most of them were single and three quarters of them had inadequate family income (class V).

In terms of menstrual history, current research shows that less than three-fifths of nursing students' menarche occurred between the ages of 12 and 13 and that around two-thirds of them experienced monthly flow lasting three to seven days. More than three-quarters of them had two to four pads a day, and a majority of them had menstrual cycles that lasted between 21 and 35 days. Finally, the majority of them displayed a menstrual cycle that was regular. This outcome resembled the characteristics of a normal menstrual cycle. Thus, the current research able to demonstrate that PMS had no effect on the physiology or mechanics of the menstrual cycle.

This result was supported by *Teotia, et al., (2020)* who revealed that in terms of menarche age, the majority of female participants experienced menarche when they were 12 and less than 14 years. The majority of them had menstrual cycles lasting 35 days or less. In terms of menstrual bleeding duration, the majority of them experienced bleeding for at least five days. The majority of female participants had light to normal menstrual flow, using two to five pads each day. The majority of them had regular cycles in terms

of regularity. Additionally, *Mohamed, et al.,(2022)* who documented that the majority of students started menstruating at the age of 12 and over, about two thirds have regular menstrual periods, while less than third do not. The majority have their menstruation period between 3 and 7 days. A majority of them have menstruation in an average amount. Previous studies established that menstrual cycle criteria are not affected by PMS; only menstrual-associated symptoms, daily life activity, academic performance, social relations and quality of life are affected.

The current study showed that, with regard to all items of nursing students' knowledge about premenstrual syndrome, there was a highly statistically significant difference ($p \leq 0.001$) between the results of the 4 weeks and 8 weeks post-intervention phases compared to the pre-intervention phase in favor of the 8 weeks post-intervention. Increasingly, slightly less than two-fifths of nursing students had an adequate knowledge score and less than two-thirds of nursing students had an inadequate knowledge score regarding premenstrual syndrome at the pre-intervention phase compared to (majority and less than fifth) at 4 weeks post-intervention and (majority and less than fifth) at 8 weeks post-intervention, respectively. This showed a developing comprehension of the research sample as a result of conducting our educational sessions over time, which could help nursing students cope with PMS symptoms.

These results proved by *Rani, et al., (2021)* who revealed that, in the pre-test, approximately two-fifths of adolescent girls had inadequate knowledge, less than half had moderate knowledge, and less than tenth had adequate knowledge regarding the prevalence and management of premenstrual syndrome at pre-intervention phase. Additionally, current study results nearly similar to *Said and Mettwaly, (2019)* who demonstrated that the majority of students had an average knowledge level before to intervention in the distribution of the research sample's total knowledge before and after the educational training program. However, the majority of them gained good of knowledge following the educational training program. Regarding the definition, causes, and changes of menstrual disorders, there was a statistically significant difference ($p < 0.05$) between the girls' knowledge before and after the educational intervention was implemented.

In contrast, there was a highly significant difference ($p < 0.00$) between their knowledge before and after the program was applied regarding menstrual disorders and obesity. That demonstrated the idea that students in a well-designed educational program had better understanding of the topic under study. Moreover, there was a high statistically significant difference among mean scores regarding nursing students' premenstrual syndrome subscales at pre-intervention, 4 weeks post-intervention, and 8 weeks post-intervention phases ($p\text{-value} < 0.001$). The total mean score of premenstrual syndrome of

studied nursing students decreased from 129.81 ± 10.74 to 101.45 ± 9.35 and 94.83 ± 8.74 throughout the study phases, in favor of 8 weeks post-intervention phase. Additionally, (the minority, slightly less than half and more than half) of the studied students had mild PMS at pre-intervention, 4 weeks and 8 weeks post-intervention phases, respectively. This can be explained from researchers view point as interventional program has an effective role in reducing premenstrual syndrome symptoms.

These results have been strengthened and enhanced by *Ibrahim, et al., (2021)* who illustrated that there was a highly statistically significant difference between total physiological symptoms of premenstrual syndrome among studied students at pre- and post-intervention ($p < 0.001^{**}$). *Hassan, et al., (2022)* presented that no statistical significant difference between the means of total score of all physiological symptoms of the two groups before applying both interventions ($p = 0.077$).

A statistically significant difference was found between the means of the two groups' total scores after 4 and 8 weeks of applying both interventions with regard to all physiological symptoms ($P = < 0.001$). Before applying Pilate's, the mean score was 44.0 ± 11.15 , whereas before applying Benson, it was 48.22 ± 12.39 . After applying Pilate's, the mean score was 36.14 ± 8.75 , compared to 47.36 ± 12.03 after applying Benson, and after 8 weeks of applying Pilate's, it was 32.06 ± 7.41 , compared to 43.98 ± 11.24 after applying

Benson. Furthermore, among the Pilate exercise group, less than quarter, slightly more than half, and half of the examined women experienced moderate PMS at the pre-intervention, 4-week, and 8-week points after the intervention, respectively. Moreover *Balmumcu, A., and Ozturk, N., (2023)*, *Hemalatha, et al., (2023)* & *Song, and Kim, J., (2023)* showed that there was a high statistically significant difference among mean scores regarding studied women premenstrual syndrome subscales at pre-intervention and post-intervention phases ($p\text{-value} < 0.001$). The idea that physical activity, such as Pilate's exercises, is one relaxation technique that can be used to reduce pain can be supported by the fact that performing gymnastics causes the brain and spinal cord to release endorphins, which are hormones that act as natural sedatives and induce a feeling of comfort.

Muscle cramps, particularly in the lower abdomen, are cyclic and result from strong, prolonged contractions in the uterine wall. This causes muscle fatigue and physical inactivity. Therefore, Pilate's exercises that focus a lot on the hip region can help alleviate the cramps. Physiological studies of dysmenorrhea have shown that people who experience menstrual pain will also experience cramps. Elevated flexibility of the abdominal muscles influences the amount of oxygen delivered to every organ; hence, pain is reduced since every organ, particularly the belly, receives the greatest amount of oxygen. Moreover, pain and other menstrual-related symptoms are lessened when the hormone prostaglandin releases

concurrently with the menstrual cycle. *Amzajerdi, et al., (2023)*.

Current study indicated that there was a high statistically significant difference among mean scores of studied nursing students' activities of daily living affected by PMS at pre-intervention, 4 weeks post-intervention and 8 weeks post-intervention phases with (p- value<0.001). The total mean score of activities of daily living of studied students was improved from 65.08 ± 4.87 to 73.40 ± 5.09 and 77.56 ± 5.44 throughout study phases; in the favor of 8 weeks post- intervention phase. Moreover, more than half, more than three-quarters and majority of studied students had acceptable level of activities of daily living at pre-intervention, 4 weeks and 8 weeks post-intervention phases respectively. This demonstrated how Pilate exercises supported by WhatsApp educational and training program and had a favorable impact on nursing students' PMS which reflected positively on day-to-day activities.

These findings agreed with *Ismail, et al., (2021)* who reported the percentage distribution of research participants based on how PMS negatively affected their day-to-day activities both before and after a two-month intervention. Prior to the intervention, there were no statistically significant differences between the study and control groups. However, two months after the intervention, the study group had a substantial reduction in the negative effects of PMS on all aspects of daily life activities compared to the control group. After two months of the

intervention, the study subjects were distributed based on the total score of negative effects on their daily activities. It was observed that more than half of the study group experienced moderate effects from PMS, while less than half experienced severe effects (p- value<0.001). Regarding the control group, more than two thirds of them suffered from moderate effect, while one third had a severe effect before intervention, and there was no statistically significant improvement after two months of the intervention. There were also statistically significant difference between the study and control groups in favor of after two months of the intervention, with (p- value<0.001).

Increasingly current study supported by *Abbas, et al., (2020)* who illustrated that there was a high statistically significant difference among mean scores of studied women activities of daily living affected by PMS at pre-intervention and post- intervention phases. As showed, Pilate's exercise reduces the severity of PMS symptoms, so the level of daily activity of affected women will improve, respectively.

Regarding academic performance of nursing students present study revealed that there was a high statistically significant difference among mean scores of studied nursing students' academic performance affected by PMS at pre-intervention, 4 weeks post-intervention and 8 weeks post-intervention phases with (p- value<0.001). The total mean score of academic performance of studied students was improved from 25.46 ± 2.55 to 30.51 ± 3.22 and 32.34 ± 3.39 throughout study

phases; in the favor of 8 weeks post- intervention phase. Furthermore, more than one third and more than half of studied students had good level of academic performance at pre-intervention, 4 weeks and 8 weeks post- intervention phases respectively. Pilate exercise and WhatsApp based support program positively affect student academic performance by alleviate PMS related symptoms.

Current study results accepted by *Alemu, et al., (2017)* who showed that there was a high statistically significant difference among mean scores of recruited sample academic performance affected by PMS at pre-intervention, one-month post-intervention and 2 months post- intervention phases with (p- value<0.001). The total mean score of academic performance of studied students was improved from 27.46 ± 2.44 to 29.43 ± 2.32 and 30.24 ± 2.53 throughout intervention; in the favor of 2 months post- intervention phase. Moreover, more than one quarter, slightly less than half and two thirds of studied s sample had good level of performance at pre-intervention, one month and two months post- intervention phases respectively. From the researchers' point of view, academic performance negatively affected by PMS; so, Pilate exercise and other alternative treatment of premenstrual syndrome symptoms, positively affect students' academic performance

Current study clarified that there was a highly statistical significant positive correlation between total PMS score and total scores of (activities of daily living and academic performance) of the studied students at pre- intervention, 4 and 8 weeks

post- intervention phases ($P\leq 0.001$). This can be explained as activities of daily living and academic performance negatively affected by premenstrual syndrome symptoms and its degree. So, after intervention as premenstrual syndrome symptoms decrease, activities of daily living and academic performance positively affected and significantly improved. This can be supported by the concept that physical activity as Pilate exercise is the best way for all women to reduce stress and restore chemical balance in the brain. It is also a great way to cure PMS. Through the release of endorphins and the reduction of adrenal cortisol, physical activity appears to alleviate PMS symptoms, improve pain tolerance, and lessen anxiety, sadness, and other problems *Hemalatha, et al., (2023)*. Whatsapp based support programs are becoming more and more popular in keeping students informed about how to handle problems and avoid dropping out.

Conclusion:

According to the findings of this studies., it was concluded that the implementation of Pilate's Exercise and WhatsApp Based Support Program was effective in relieving premenstrual syndrome, improving activities of daily living and academic performance of nursing students, with a highly statistically significant difference among mean scores at pre-intervention, 4 weeks post-intervention and 8 weeks post-intervention phases (p-value<0.001). As well as, there was a highly statistical significant positive correlation between total PMS score and total scores of (activities of daily living and academic performance) of the

studied students at pre- intervention, 4 and 8 weeks post- intervention phases. So, the research hypothesis was accepted and the research aim was attained.

Recommendations:

In light of the results obtained from this study, the following recommendations are proposed.

- Integrating Pilate's exercises as a complementary and alternative therapy within nursing practices and educational programs to alleviate primary dysmenorrhea in adolescent female students.
- Basic nursing and midwifery education as well as continuing education could be enriched with correct, relevant evidence-based information about non-pharmacological management of PMS.
- Training programs for maternity nurses in gynecologic units focused on the implementation of non-pharmacological methods, such as Pilate's exercises.

Further researches are also recommended:

- Further studies to explore the potential benefits of combining different types of exercises or incorporating other interventions, such as dietary changes or stress management techniques, for managing PMS.
- The impact of Pilate's technique on various menstrual disorders.
- Evaluation of young women's contentment with non-pharmacological methods, such as

Pilate's exercises, for managing premenstrual syndrome

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