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Conducting a Core-Based Exercise Program in Movement Competency Training Course to Improve Pain Tolerance and Abdominal Endurance of Female University Students with Primary Dysmenorrhea

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract

Objectives. This study aimed to examine the effect of conducting a core-based exercise program in a movement competency training course on improving pain tolerance and abdominal endurance of female university students with primary dysmenorrhea.

Materials and methods. A total of 112 qualified female university students completed the training course. It used an uncontrolled trial approach of experimental research involving three phases: a week for pre-tests and orientation; 8 weeks of movement competency training; and a week of post-tests.

Results. According to this study, a large significant decrease in menstrual pain (-55.45 %) and an increase in pain tolerance (22.54 %), muscular endurance (40.57 %), and aerobic capacity (41.60 %) was observed after the movement competency training ($p < .001$). Post-pain tolerance (kg) has a significant positive relationship with post-abdominal endurance (reps) ($\beta = 0.093$; $p < .001$) and post-VO_2max ($\beta = 0.163$; $p < .001$). It has been demonstrated that post-pain tolerance accounts for 98.2 % of the variances in post-abdominal endurance and 98.4 % in post-VO_2max.

Conclusions. The findings indicate that a core-based exercise intervention integrated into the movement competency training course was found to be effective in reducing menstrual pain and improving pain tolerance, muscular endurance and aerobic capacity in female university students experiencing primary dysmenorrhea. A progressive core exercise program can be used as a non-pharmacological treatment for pain management and to enhance the body capacity of females with pain discomfort.

Keywords: core exercise, dysmenorrhea, PATHFIT 1, pain management, pain tolerance.

Introduction

Globally, primary dysmenorrhea afflicts a substantial proportion of women, with reported prevalence rates varying from 17 to 90 % (Ferries-Rowe et al., 2020). Particularly affecting the quality of life, primary dysmenorrhea usually causes absence from workplaces or classrooms, reduced output, and increased need for healthcare. In addition, dysmenorrhea is the most common gynecological problem that has an impact on most students in their academic performance and daily activities (Mahwish et al., 2024). The prevalence of dysmenorrhea worldwide ranges from 16 to 91%, and 10–20 % of them suffer from severe dysmenorrhea, which is the leading cause of recurrent school absenteeism (80 %), loss of class concentration (66.8 %), no active participation (47.4 %), inability do homework (21 %), fail in an exam (15.4 %), and limited activity (29.9%) (Mesele et al., 2022).

Primary dysmenorrhea is postulated to arise from the synthesis of prostaglandins (Ferries-Rowe et al., 2020) during menstruation, which precipitates potent uterine contractions, diminished uterine blood flow, and subsequent activation of nociceptors. While non-steroidal anti-inflammatory drugs represent the principal therapeutic approach for this condition (Marjoribanks et al., 1996), their efficacy in providing comprehensive relief is not universal, and prolonged usage is associated with potential adverse effects. As such, non-pharmacological modalities like physical exercise are attracting more and more attention as possible supplementary therapies for primary dysmenorrhea.

Owing to the potential of exercise to augment endorphin secretion (Saanijoki et al., 2018) and attenuate inflammation

(Gleeson et al., 2011), a multitude of studies have scrutinized its efficacy in the management of primary dysmenorrhea (Tsai, 2024). Despite this extensive investigation, the scholarly discourse remains divided regarding the most effective form of exercise (Matthewman et al., 2018; Carroquino-Garcia et al., 2019). Various modalities have been examined, encompassing relaxation exercises such as progressive muscle relaxation (Çelik & Apay, 2021) and self-administered massage (Azima et al., 2015), alongside strength training (Saleh et al., 2016), aerobic exercises (Kannan et al., 2019), yoga (Kirca & Celik, 2023), mixed exercise regimes (Kirmizigil & Demiralp, 2020), and the Kegel maneuver (Amreen et al., 2013). Certain studies have documented substantial alleviation in pain following only 4 weeks of exercise intervention (Yildiz & Acaroğlu, 2022), whereas others indicate a necessity for up to 8 weeks to discern any tangible benefits (Ortiz et al., 2015). Furthermore, the incidence of participant withdrawal has exhibited variability across these diverse exercise protocols (Çelik & Apay, 2021; Pocaan, 2023).

Supported by the abovementioned findings, this study implements a core-based exercise program integrated into movement competency training under the Physical Activity Towards Health for Fitness 1 (PATHFIT 1) course to improve pain tolerance and abdominal endurance of female university students with primary dysmenorrhea. This course is a requirement for all undergraduate students in the Philippines. The study aimed to provide effective movement-based interventions focused on core regions for female students to improve pain management and physical fitness.

Materials and Methods

Study Participants

One hundred two out of 114 first-year female university student enrollees handled by the researcher in Physical Activity Towards Health and Fitness 1 course or movement competency training course in one state university experiencing primary dysmenorrhea volunteered and completed the movement competency training. Five participants were excluded due to experiencing severe dysmenorrhea, 4 were due to their active participation in fitness clubs the previous month, and 3 had mild to severe health conditions (Figure 1). A signed informed consent form was retrieved from the participants before the start of the study, and authorization to conduct the study was also secured from the university's research committee. The study was conducted during the first semester of the academic year 2023-2024 (Table 1).

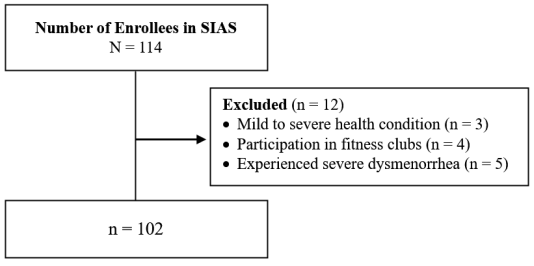

Fig. 1. Selection of participants

Table 1. Participants' anthropometrics and baseline data (n = 102)

Indicator	Average	Range
Height (cm)	150.40 ± 4.59	143-160
Weight (kg)	55.37 ± 7.01	44-68
Age (years)	19.04 ± 0.82	18-20
Menstrual pain (scale)	5.41 ± 1.19	4-7
Pain Tolerance (kg)	1.65 ± 0.32	0.99-2.07
Abdominal endurance (reps)	10.87 ± 2.65	6-15
Aerobic Capacity (VO_2max)	36.85 ± 3.06	31.83-41.75

Design and test procedures

The uncontrolled trial approach of experimental research involving pre- and post-tests was used. The study underwent three phases: a week for pre-tests and orientation; 8 weeks of movement competency training; and a week of post-tests. Similar procedures of field tests were used in pre- and post-tests. All the participants were instructed on the necessary warm-up and cooldown to prevent injuries and to condition the body during the test and training. Participants were instructed to avoid caffeinated and soda drinks, and heavy meals 48 hours before the post-test.

The participants were evaluated using a self-reported visual analog scale to measure the experienced menstrual pain for the last 3 months for the pre-test and a month after the training program for the post-test. The pain scoring consists of a straight line that ranges from "no pain" on the left end (0 cm) of the scale to "worst pain" on the right end (10 cm) (Delgado et al., 2018). An algometer (FPX 25 Digital Algometer, Wagner Force Ten) was used to measure the pain tolerance (kg) of the participants. In a relaxed supine position, a gradual pressure was applied using the device perpendicular to the tissue of the T12 region of the rectus abdominis (subcostal nerve) for both left and right. The application of pressure stops once the participants say "now" after they reach the maximum pain. Three applications were given for each region with 30 seconds interval to reduce wind up and three findings per region were recorded. The average of the six findings was the final score of the test.

A curl-up test was used to measure abdominal endurance (reps). Participants started by lying on their backs with knees bent and feet 12 inches from the buttocks. Without holding or resting the feet, participants extended their arms on their thighs and kept their heads neutral. Participants curled up slowly until their shoulders lifted two inches off the mat, then lowered back down, completing each curl-up in three seconds. The test continued without pauses until exhaustion. Only properly executed curl-ups—shoulders raised two inches, head off the mat, heels down, and correct timing—were counted as one score.

The aerobic capacity was evaluated using the 12-minute run test on a 50m flat surface back and forth (Pocaan, 2024). At a standing stance, the participants started to run after the command of a sharp whistle sound (Fox 40 Pealess, US), and the clock started. The participants stop running when 12 minutes have elapsed, and the total distance completed is recorded (km). The VO_2max was calculated using the formula: (22.351 x km) - 11.288. This test is valid and reliable (Cooper, 2013).

Movement competency training program

Table 2. Workout compositions

Workout	Composition	Intensity/reps
1	Plank (standard)	Hold for 20-30 seconds
	Dead bug	10-12 reps per side
	Glute bridge	15 repetitions
	Bird dog	10-12 reps per side
	Plank with shoulder taps	12-15 taps per side
2	Side plank	Hold for 20-30 seconds per side
	Russian twist	12-15 reps per side,
	Bicycle crunches	15-20 reps per side
	Mountain climbing	30 seconds
	V-ups	12-15 reps

The movement competency training program aimed to enhance core strength, endurance, and stability gradually in eight weeks. Participants participated in once-a-week training for two hours per session. It comprises foundational core exercises and integrates progression principles to challenge the body while decreasing recovery time. The initial workout includes plank, dead bug, glute bridge, bird dog, and plank with shoulder taps for stability and core activation. Meanwhile, the second workout includes dynamic and rotational movements like side plank, Russian twists, bicycle crunches, mountain climbers, and V-ups, which challenge the obliques and increase overall core strength (Table 2). A similar training was employed every two consecutive weeks, alternating workouts 1 and 2. The training starts with 5 sets, increasing by two sets. The progressive approach of the training course gradually increases the intensity while reducing recovery and rest times (Table 3).

Statistical Analysis

Data are expressed as mean ± standard deviation for continuous variables. The Kolmogorov–Smirnov test was conducted to evaluate the distribution's normality. A paired sample t-test was employed to calculate the pre-test and post-test results. The change ratio (Δ) assessed pre-test and post-test differences. Statistical significance was established at $p \leq 0.05$. Linear regression analysis examined the relationships among the variables' post-tests. Cohen's d effect size (ES) was calculated to illustrate the magnitude of differences between variables. The statistical analysis was conducted utilizing IBM SPSS version 29.

Results

A significant difference and large effect size were observed in menstrual pain, pain tolerance, muscular endurance, and aerobic capacity after the movement competency training at $p < .001$, with -55.45 %, 22.54 %, 40.57 %, and 41.60 % improvements, respectively (Table 4).

The analysis in Figure 2 revealed that post-pain tolerance (kg) has a significant positive relationship with post-abdominal endurance (reps) ($\beta = 0.093$; $p < .001$) and post-VO_2max ($\beta = 0.163$; $p < .001$). Post-pain tolerance accounts for 98.2 % of the variances in post-abdominal endurance and 98.4 % in post-VO_2max.

Table 3. Training Course Timeline

Duration	Weeks 1-2	Weeks 3-4	Weeks 5-6	Weeks 7-8
Work out	1,2,1,2,1	1,2,1,2,1,2,1	1,2,1,2,1,2,1,2,1	1,2,1,2,1,2,1,2,1,2,1
Recovery time	20 secs.	15 secs.	13 secs	10 secs
Rest between workouts	2.5 mins.	2.25 mins.	2 mins.	1 min.

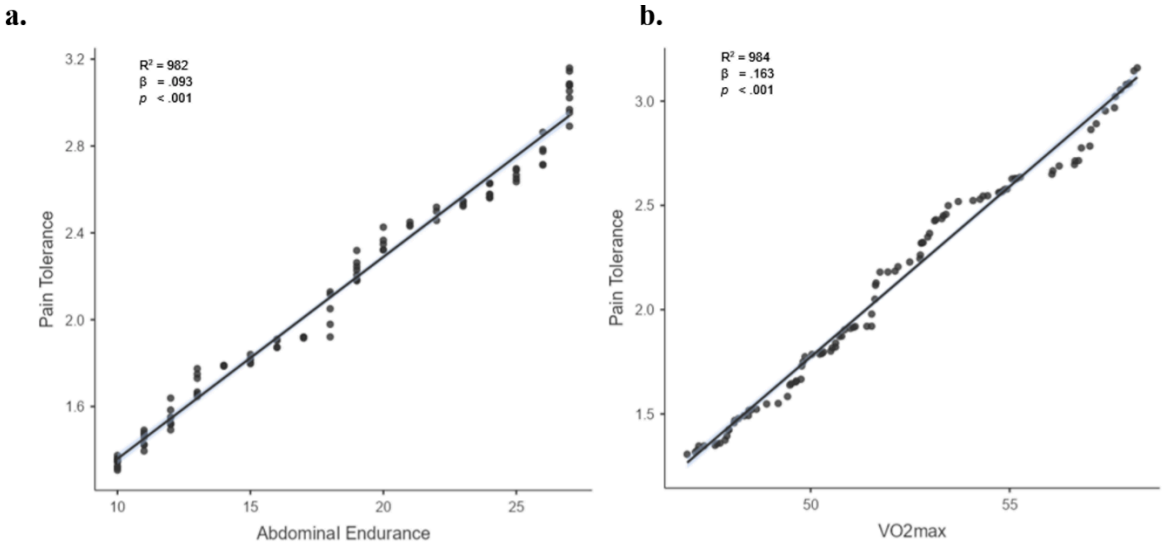

Fig. 2. (a) linear regression between post-pain tolerance (kg) and post-abdominal endurance (reps); (b) linear regression between post-pain tolerance and post-VO_2max, at $p < .001$.

Table 4. Effect of movement competency training on pain tolerance, muscular endurance, and aerobic capacity

Indicator	Pre	Post	Δ	p	ES
Menstrual pain (scale)	5.41 ± 1.19	2.41 ± 1.09	-55.45%	< .001	0.85
Pain tolerance (kg)	1.65 ± 0.32	2.13 ± 0.54	22.54%	< .001	-0.90
Muscular endurance (reps)	10.87 ± 2.65	18.29 ± 5.76	40.57%	< .001	-0.83
Aerobic capacity (VO2max)	36.85 ± 3.06	52.18 ± 3.28	41.60%	< .001	-0.88

Discussion

The results of the core-based exercise program in the movement competency training course showed a significant decrease in menstrual pain and increased pain tolerance, muscular endurance, and aerobic capacity.

My findings reveal a large decrease in menstrual pain after the training course, implying the effectiveness of the course and can be used as a non-pharmacological intervention for managing primary dysmenorrhea. In an experimental study, women engaged in core exercises experienced lesser pain intensity compared with non-participation. Many laboratory experiments reveal that the decrease in menstrual pain is associated with core exercise participation since it improves blood circulation, reduces muscle tension (Verma et al., 2024), and enhances the release of endorphins or the natural painkillers of the body (Paungmali et al., 2018). Furthermore, the improved pain tolerance in the rectus abdominis region observed in my study implies that core training exercises positively influence pain thresholds which is beneficial for females to be more resilient to menstrual discomfort. It may indicate that core muscle adaptation to intense exercise can be linked to improved pain tolerance. Similarly, recent studies also revealed that core strengthening and stability exercise programs are an appropriate method for improving pain tolerance (Smrcina et al., 2022; Baiamonte et al., 2017; López-Liria et al., 2021). An integration of planned and systematic exercise intervention in course curricula may serve as an alternative medicine for pain management and can improve the quality of life of individuals suffering from primary dysmenorrhea.

In terms of muscular endurance, my study also found a large improvement, suggesting that the intensity of the training course enhances the stamina of the core muscles. Including core training in physical education courses for women positively improves their physical performance and functionality as it reduces physical limitations caused by menstrual pain (Bağci Çelik et al., 2024). Furthermore, core stability and muscular endurance exercises improve the physical performance metrics of women (Genc et al., 2019). The focus on progression in this training program likely contributed to the gains in endurance. The increase in VO2 max demonstrates the course's positive influence in reducing menstrual pain and improving fitness. Enhanced aerobic capacity signifies improved blood circulation and oxygen uptake that reduces muscle tension and discomfort during menstruation, which is beneficial for overall health and pain management (Çiçek, 2018; Pocaan, 2024; Pocaan, 2023). The enhanced aerobic capacity is also beneficial for women's heart and lung health, and immune function for long-term health. It includes reducing the risk of heart disease and respiratory issues since cardiovascular diseases are a leading cause of mortality among women (Vogel et al., 2021).

The strong relationship between pain tolerance and other fitness markers implies that the increase in women's ability to pain tolerance benefits pain management and improves physical endurance and cardiovascular capacity. This also suggests that the implemented training course was suitable for improving females' capacity to manage pain and sustain core stability. My study proves that sustained exercise efforts increase pain tolerance allowing muscle adaptation for women that is necessary to endure menstrual discomfort. Enhanced pain tolerance can facilitate regular physical activity, resulting in improved cardiovascular health and core strength, both essential for long-term well-being. This finding corroborates the research conducted by Inglés & Kropotov (2019), demonstrating that exercise interventions significantly alleviate pain and enhance physical endurance in women.

Conclusions

The core-based exercise intervention integrated into the movement competency training course in my study was found effective in reducing menstrual pain and improving pain tolerance, muscular endurance and aerobic capacity in female university students experiencing primary dysmenorrhea. A progressive core exercise program can be used as a non-pharmacological treatment for pain management and to enhance the body capacity of females with pain discomfort. My study offers effective movement-based interventions focused on core regions that can be used to improve pain management and physical fitness. My findings were also consistent with the emerging research on the positive effect of exercise on pain management and functional improvement. My study supports incorporating appropriate training interventions for pain tolerance and fitness programs for improved health outcomes.

Conflict of Interest

The author declares no conflict of interest in conducting this study.

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Проведення програми на основі комплексу вправ для м'язів кора в рамках тренувального курсу з розвитку рухової компетентності щодо покращення показників толерантності до болю та абдомінальної витривалості студенток ВНЗ з первинною дисменореєю

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 7 с., 4 табл., 2 рис., 34 джерела.

Мета дослідження. Мета цього дослідження полягала у вивченні впливу проведення програми на основі комплексу вправ для м'язів кора в рамках тренувального курсу з розвитку рухової компетентності на покращення показників толерантності до болю та абдомінальної витривалості студенток ВНЗ з первинною дисменореєю.

Матеріали та методи. Загалом 112 кваліфікованих студенток ВНЗ завершили курс тренування. У роботі використовувався неконтрольований метод експериментального дослідження, що включав три фази: тиждень передтестових етапів та спрямованості; 8 тижнів тренування з розвитку рухової компетентності; і тиждень післятестових етапів.

Результати. Згідно з даними цього дослідження, після проведення тренування з розвитку рухової компетентності спостерігалося значне зниження менструального болю (-55,45 %) і підвищення толерантності до болю (22,54 %), м'язової витривалості (40,57 %) та аеробної здатності (41,60 %) ($p < 0,001$). Постбольова толерантність (кг) має достовірний позитивний зв'язок з постабдомінальною витривалістю (повторення) ($\beta = 0,093$; $p < 0,001$) і поствимірюваним показником VO_2max ($\beta = 0,163$; $p < 0,001$). Продемонстровано, що постбольова толерантність пояснює 98,2 % варіацій постабдомінальної витривалості і 98,4% поствимірюваного показника VO_2max.

Висновки. Результати дослідження свідчать про те, що інтервенція на основі комплексу вправ для м'язів кора, інтегрована у тренувальний курс з розвитку рухової компетентності, виявилась ефективною щодо зменшення менструального болю та покращення толерантності до болю, м'язової витривалості та аеробної здатності у студенток, які страждають на первинну дисменорею. Прогресивна програма вправ для розвитку м'язів кора може використовуватись

як нефармакологічний метод лікування болю та сприяти підвищенню продуктивності організму жінок, які відчувають больовий дискомфорт.

Ключові слова: вправи для м'язів кора, дисменорея, програма PATHFIT 1, лікування болю, толерантність до болю.

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