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Efficacy of active stretching exercises against symptoms of primary dysmenorrhoea in young adult females: a randomized controlled trial

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Abstract

Introduction. Primary dysmenorrhoea symptoms affect most women's daily life activities. The aim of the current study was to assess the efficacy of active stretching exercises in reducing pain intensity and improving menstruation characteristics of young adult females.

Methods. Overall, 33 females with primary dysmenorrhoea were randomly assigned to 3 equal groups: group A (n = 11), implementing a supervised active stretching program 3 times a week for 4 weeks; group B (n = 11), practising non-supervised active stretching 3 times a week for 4 weeks; and group C (n = 11) – a control group. Pain intensity and menstruation characteristics were measured with the visual analogue scale and verbal multidimensional scoring system, respectively, before and at the end of the study. The Kruskal-Wallis test was used to determine differences between groups. The Wilcoxon signed-rank test served to perform within-group comparison.

Results. A significant reduction in pain intensity was obtained in both intervention groups (A and B) (p-value of 0.003 and 0.007, respectively), whereas post-treatment comparison between groups revealed a statistically significant reduction in pain intensity in favour of group A ($p < 0.001$). A significant improvement in menstruation characteristics was found in group A ($p = 0.003$), with non-significant improvements in groups B and C (p-value of 0.07 and 1.0, respectively).

Conclusions. Both supervised and non-supervised active stretching exercises could provide a safe non-pharmacological alternative for pain relief in primary dysmenorrhoea.

Key words: menstruation, muscle stretching exercises, pain management, verbal multidimensional scoring system, visual analogue scale

Introduction

The term 'dysmenorrhoea' is a Greek-origin word referring to a painful cyclic uterine flow. Dysmenorrhoea is often associated with lower pelvic discomfort or throbbing pain, and some women might experience low back pain, as well as pain radiating down to the anterior thighs, in addition to headache, nausea, diarrhoea, dizziness, fatigue, and mood swings; all these can affect the females' quality of life [1–3]. It is the most common gynaecological disorder, affecting 16–90% of women, and the majority of women who suffer from this problem are in their early menstrual stages [4]. Dysmenorrhoea is highly prevalent among college students, with many physical impacts and associated activity limitations. Despite the high prevalence, the affected students rarely seek medical consultation [5].

Dysmenorrhoea is classified into 2 subtypes: primary and secondary dysmenorrhoea. Primary dysmenorrhoea is defined as painful menstruation without an obvious pathology and starts just after menarche. In turn, secondary dysmenorrhoea is due to a pathological condition and typically has a later onset [6]. Primary dysmenorrhoea is largely accompanied by limitation of activities and work, as well as school absence, mainly owing to pain. It is usually treated with oral nonsteroidal anti-inflammatory drugs, topical application of heat to the affected area, oral contraceptive pills, or analgesics for pain management by affecting the level of prostaglandins [7, 8]. Other treatments have also been considered, e.g. acupuncture, acupressure, yoga, vitamin B_1, and Kinesio taping [9–11]. Recent studies have shown that active stretching exercises relieve primary dysmenorrhoeal symptoms [12]. Contractions of ligaments in the abdominal and pelvic region are believed to cause nerve irritation and pain sensation due to compression of nerve pathways, so active stretching applied to this area leads to compression relief, as well as an increase in the blood flow and metabolism of the uterus, hence reducing dysmenorrhoeal symptoms [12, 13]. Since there is an increasing incidence of primary dysmenorrhoea in women, while the studies on applying active stretching programs are few, there was a need for additional research regarding the use of active stretching exercises for pain management in primary dysmenorrhoea. Some limitations continue to hinder the implementation of supervised exercise programs in daily practice as some females prefer non-supervised home exercises to save time, especially with primary dysmenorrhoea. However, studies have suggested that supervised exercise interventions can bring about greater health benefits in comparison with non-supervised ones [14, 15]. Therefore, the objective of this study was to evaluate the efficacy of an active stretching exercise program in primary dysmenorrhoea and to determine whether there would be a difference between applying supervised and non-super-

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vised active stretching exercise for pain management in primary dysmenorrhoea.

The research hypothesis was that both supervised and non-supervised active stretching exercises would reduce symptoms of primary dysmenorrhoea, including pain, and would improve menstruation characteristics (dysmenorrhoea severity), including working ability, systemic symptoms, and analgesia requirement, in females with primary dysmenorrhoea.

Subjects and methods

Trial design

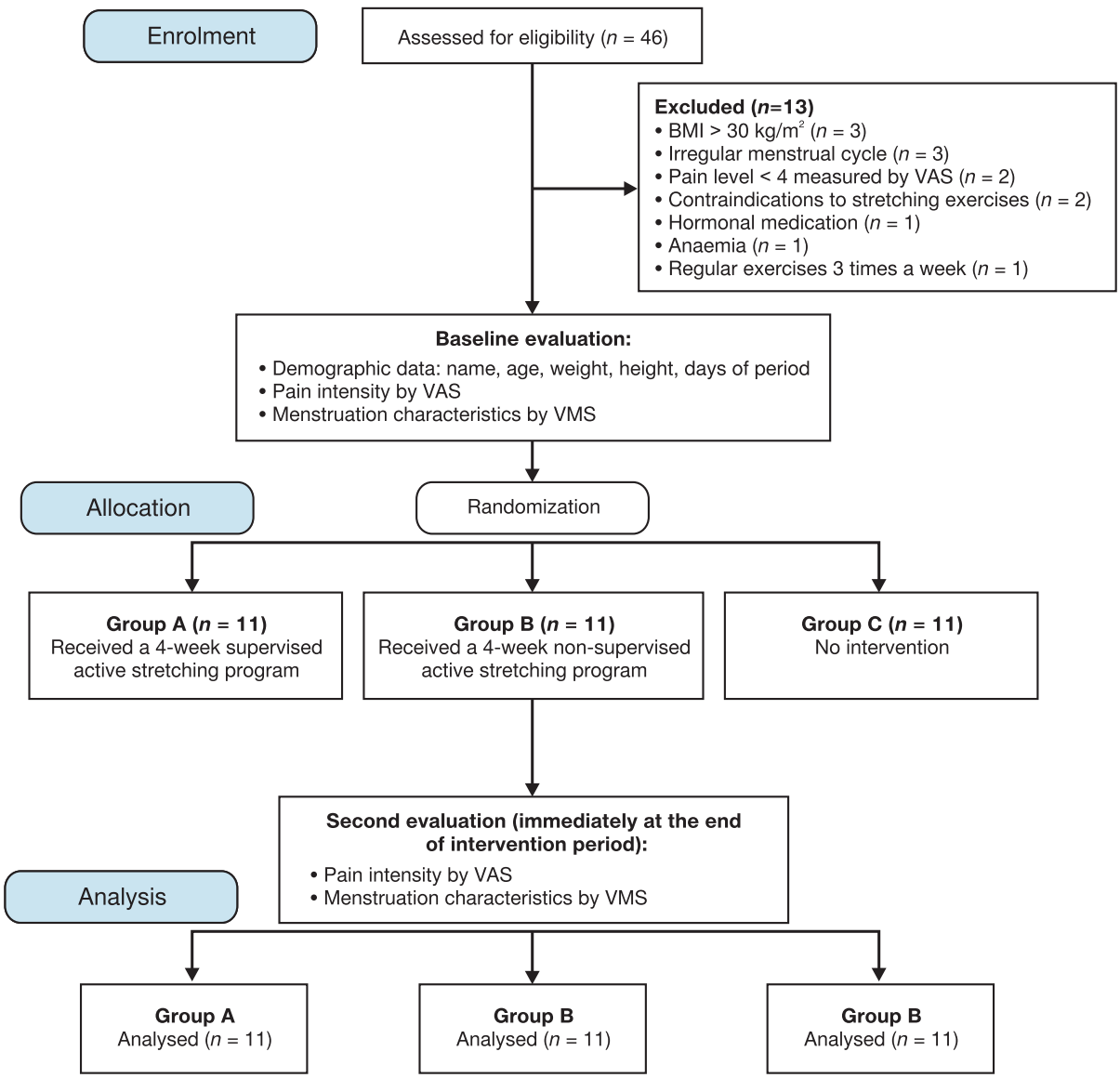
This study was a randomized single-blind clinical trial. In total, 33 female subjects were randomly assigned, with the use of opaque, sealed envelopes, to 3 equal groups: group A (supervised active stretching exercise program), group B (non-supervised active stretching exercise program), and group C (the control group with no intervention; however, the subjects were given the opportunity to partake in the non-supervised stretching exercise program after the conduction of the study). Evaluative procedures were performed by a blinded assessor at 2 time points: before the beginning of the intervention (baseline assessment, immediately after the last day of menstruation) and after the treatment period (immediately after the consecutive menstruation) (Figure 1).

Setting

The study was carried out in the College of Health and Rehabilitation Sciences at Princess Nourah bint Abdulrahman University, in some licensed rehabilitation centres in Riyadh, Saudi Arabia, and at patients' home for a 1-year period (from February 2019 to March 2020).

Participants

A total of 33 bilingual Arabic- and English-speaking females with primary dysmenorrhoea, aged 18–23 years, participated in this study. The inclusion criteria involved body mass index (BMI) of 20–29.9 kg/m^2, regular menstrual cycle length of 24–35 days, cycle bleed lasting for 3–7 days, being not married, moderate physical activity (less than 3 days per week of physical activities), and a pain level of 4 or more in the initial visual analogue scale (VAS) scoring [16, 17].



BMI – body mass index, VAS – visual analogue scale, VMS – verbal multidimensional scoring system
Figure 1. CONSORT flow diagram of the study

Women with any contraindication to stretching exercise, taking any hormonal medications that might interfere with the results by either elevating or depressing the symptoms or pain, smokers (as smoking may play a role in menstrual symptom alterations), suffering from anaemia, and those who missed more than 2 sessions of exercises in the supervised or non-supervised group were excluded from the study [18, 19].

Overall, 46 subjects with dysmenorrhoea were screened for eligibility. Out of these, only 33 met the inclusion criteria and completed the baseline evaluation. In turn, 13 were excluded as they did not meet the inclusion criteria: 3 had BMI of more than 30 kg/m^2, 3 had irregular menstrual cycles, 2 presented a pain level of less than 4 as measured by VAS, 1 had anaemia, 1 took a hormonal medication, 1 practised regular exercises 3 times a week, and 2 had contraindications to stretching exercises (acute ankle sprain and excessive pain with stretching). The participants were randomized into 3 groups (A, B, and C), each involving 11 individuals. The pre- and post-intervention evaluation was fully completed by the qualified subjects, as presented in Figure 1 for the final analysis recommended by the Consolidated Standards of Reporting Trials (CONSORT) statement.

The participants received a full explanation regarding the aim and the procedure of the study. All collected data were for research purposes only and no identifying information was collected from the investigated women.

Outcome measures

The primary outcome measure was VAS, a unidimensional 10-point scale used to evaluate pain intensity. It is a 10-cm horizontal line, on which 0 represents no pain, 4–7 stand for moderate pain, and a score of 7–10 depicts severe pain [20]. The secondary outcome measure was the verbal multidimensional scoring system (VMS), which is a grading system of 0–3 used to assess menstruation characteristics (dysmenorrhoea severity). It accounts for the impact of pain on working ability, for systemic symptoms, and for analgesic requirements in decreasing pain with dysmenorrhoea (Table 1).

Therapeutic procedure

Subjects in group A received a 30–45-minute active stretching program supervised by a trained physical therapist, 3 times a week for 1 menstrual cycle (4 weeks). The exercise program was halted during menses, and documentation of post-intervention measures was conducted after the end of menses. The supervised active stretching program started with a warmup of 5 minutes on a stationary bicycle, half jumping jacks and torso rotations. Each participant performed 6 types of stretching exercises (Table 2, Figure 2). In turn, the individuals in group B received a brief explanation, by a trained physical therapist, of the same stretching exercise program as implemented in group A and of how to practise these active stretching exercises as a home program 3 times per week for 1 menstrual cycle (4 weeks). Then, a written illustrated program was given to the subjects with instructions, as a hard copy or soft copy via e-mail. The participants returned the sheets after the end of the consecutive menstruation (4 weeks), with check marks on the days they performed the exercises. Subjects in the control group were instructed to only practise their routine daily living activities.

Table 1. The verbal multidimensional scoring system [21, 22]

Grade	Working ability	Systemic symptoms	Analgesia
Grade 0: Menstruation is not painful and daily activity is unaffected	Unaffected	None	Not required
Grade 1: Menstruation is painful but seldom inhibits the woman's normal activity. Analgesics are seldom required. Mild pain	Rarely affected	None	Rarely required
Grade 2: Daily activity affected. Analgesics required and give relief so that absence from work or school is unusual. Moderate pain	Moderately affected	Few	Required
Grade 3: Activity clearly inhibited. Poor effect of analgesics. Vegetative symptoms, e.g. headache, tiredness, nausea, vomiting, and diarrhoea. Severe pain	Clearly inhibited	Apparent	Poor effect

Table 2. Types of stretching exercises practised by groups A and B

Therapeutic procedures	Exercises: 1. Stretching iliopsoas by assuming the lunging position with the back leg extended 2. Stretching rectus femoris by standing on one leg and holding the ankle of the opposite limb from behind 3. Stretching hamstrings by leaning trunk forward and touching toes 4. Stretching lower back muscles by lying supine on lower back rotation stretch, bridge exercise, and knee to chest 5. Stretching lower abdominal muscles by lying prone and then raising the chest with the hands supported on floor 6. Stretching adductor muscles by sitting on the floor, bending knees, and letting soles of feet touch each other, pulling heels together, then leaning trunk forward to the hip
Parameters of stretching exercises	• Type of stretch: active, basic static stretch • Duration: 30–45 minutes • Intensity: low-to-moderate intensity (more comfortable for the patient) • Sets: 1 set • Repetition: 10 repetitions • Duration of stretch cycle: hold for 10 seconds each time, 10-second rest The stretching exercises were performed with exhalation and the participants were instructed not to do stretching with high intensity [23]

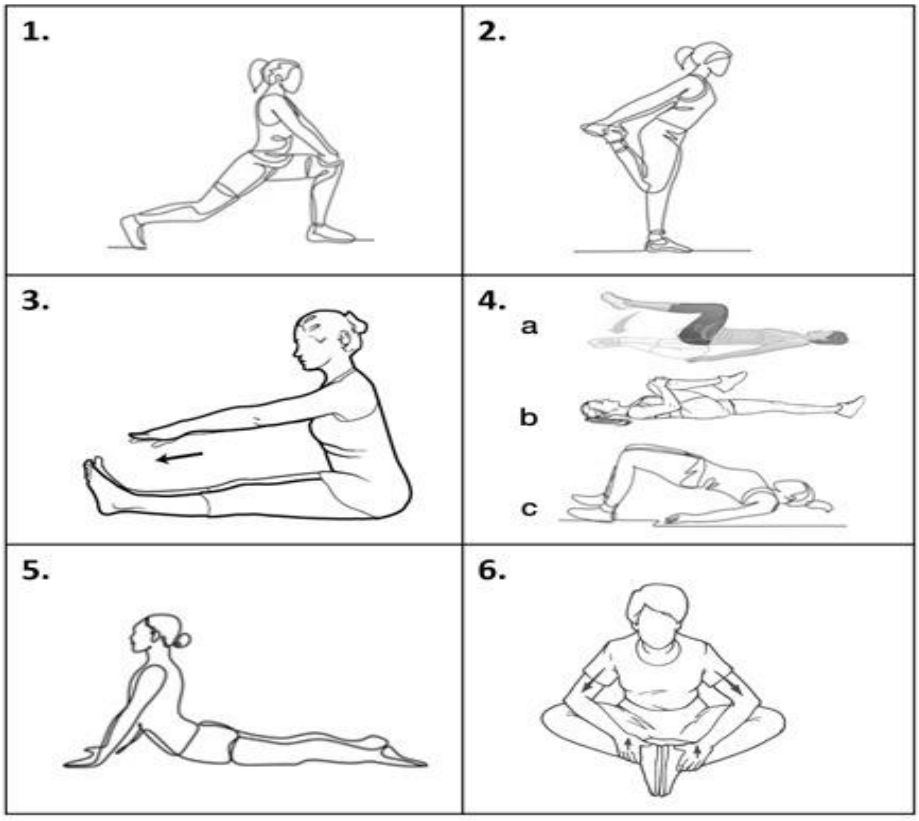


Figure 2. Therapeutic procedures of stretching exercises:
1 – iliopsoas stretch
2 – rectus femoris stretch
3 – hamstring stretch
4 – lower back muscle stretch:
a) lower back rotation stretch
b) knee to chest
c) bridge exercise
5 – lower abdominal muscle stretch
6 – adductor muscle stretch [23]

Statistical analysis

Data were described and analysed for all available participants. All statistical measures were executed by using the Statistical Package for the Social Sciences program, version 20. Statistical significance was assumed at $p < 0.05$, with 2-tailed tests. The Shapiro–Wilk test was applied to verify the normal distribution of the data. Descriptive analyses were used to identify the participants' demographic data. For demographic data, the one-way analysis of variance (ANOVA) test served to compare data between the 3 groups. The Kruskal-Wallis test was performed to establish differences between the 3 groups pursued by the post-hoc test. The Wilcoxon signed-rank test was applied for within-group comparison.

Ethical approval

The research related to human use has complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki, and has been approved by the Institutional Review Board of Princess Nourah bint Abdulrahman University (log No.: 19-0016) and registered in the ClinicalTrials.gov database (registry ID: NCT04475874).

Informed consent

Informed consent has been obtained from all individuals included in this study.

Results

Baseline characteristics of participants

Table 3 presents the characteristics of the participants who completed the study. All groups were comparable at the time of randomization regarding the demographic data (age, weight, height, BMI, length of menstrual cycle, and length of period), pain intensity, and dysmenorrhoea severity. Between-group comparisons before the intervention showed no sta-

Table 3. Demographic, VAS, and VMS data at baseline in the 3 study groups

Characteristics	Group A (n = 11)	Group B (n = 11)	Group C (n = 11)	p
Age (years) (mean ± *SD*)	21 ± 1.34	21.2 ± 1.17	20.6 ± 1.29	0.6
Weight (kg) (mean ± *SD*)	63.5 ± 4.93	59.7 ± 6.21	59.8 ± 5.37	0.2
Height (cm) (mean ± *SD*)	158.9 ± 5.13	159 ± 4.27	159.1 ± 2.23	0.29
BMI (kg/m^2) (mean ± *SD*)	24.9 ± 1.5	23.6 ± 2.17	23.6 ± 1.59	0.18
Length of menstrual cycle (days) (mean ± *SD*)	27.2 ± 2.93	28.3 ± 2.21	27.8 ± 1.87	0.59
Length of period (days) (mean ± *SD*)	6.5 ± 1.8	6.9 ± 1.4	6.2 ± 1.4	0.42
Pain intensity (VAS) (mean ± *SD*)	7 ± 1.18	6.8 ± 1.03	7.4 ± 1.43	0.45
Dysmenorrhoea severity (VMS) (median) (25th, 75th)	2 (2.3)	2 (2.2)	2 (1.3)	0.94

VAS – visual analogue scale, VMS – verbal multidimensional scoring system

tistically significant differences ($p > 0.05$) concerning the subjects' demographic data, VAS scores, or VMS scores.

Pain intensity scores

Regarding pain intensity, which was measured with VAS, within-group comparison revealed a statistically significant difference in both intervention groups (A and B) (p-value of 0.003 and 0.007, respectively), with more percentage of improvement in group A than in group B (47% and 17%, respectively), and a non-significant improvement in the control group (C) ($p = 0.34$), with improvement percentage of 8%, as shown in Table 4. Between-group comparison determined a statistically significant difference in favour of group A ($p < 0.001$) (Table 5).

Dysmenorrhoea severity

With regard to menstruation characteristics, measured by VMS, within-group comparison revealed a statistically significant difference in group A ($p = 0.003$), while non-significant differences were observed in groups B and C (p-value of 0.07 and 1.00, respectively), as shown in Table 4. Between-group comparison determined a statistically significant difference in favour of the supervised active stretching exercise group (A) ($p < 0.001$) (Table 5), with a higher improvement percentage compared with the non-supervised active stretching group (B) and the control group (C) (80%, 18%, and 0%, respectively), as depicted in Table 4.

Discussion

Primary dysmenorrhoea has been shown to be an irritating and disabling factor in many women's lives, where it has become a recent focus of non-medical approaches. Physical activities and exercises have been suggested to be an alternative treatment. The objective of the current study was to evaluate the efficacy of an active stretching exercise program against symptoms of primary dysmenorrhoea and to determine whether there would be a difference between applying supervised and non-supervised active stretching exercise for pain management and improving menstrual characteristics in young females with primary dysmenorrhoea.

In the current study, the results revealed that both a supervised and a non-supervised active stretching program could reduce pain intensity of dysmenorrhoea compared with the control group. However, the supervised active stretching exercises were superior in terms of relieving menstrual pain in young females. Moreover, the results suggest that only the supervised active stretching exercises reduce the dysmenorrhoea severity and the impact of pain on working ability, as well as improve systemic symptoms and decrease analgesic requirements in young females with primary dysmenorrhoea.

The results of the presented study are in line with many earlier reports in supporting the positive impact of stretching exercises on pain intensity in young females with primary dysmenorrhoea [12, 24–27]. This effect could be assigned to the exercise influence on metabolism, as exercises increase blood flow to the uterus and intensify its metabolism, by that

Table 4. Statistical analysis of VAS and VMS scores: within-group comparison before and after the treatment

Characteristics	Group A (n = 11)				Group B (n = 11)				Group C (n = 11)			
	Pre	Post	% of improvement	p	Pre	Post	% of improvement	p	Pre	Post	% of improvement	p
VAS (mean ± *SD*)	7 ± 1.18	3.7 ± 1.27	47%	0.003*	6.8 ± 1.03	5.6 ± 1.12	17%	0.007*	7.4 ± 1.43	6.8 ± 1.47	8%	0.34
VMS (median) (25^{th}, 75^{th})	2 (2.3)	0 (0.1)	80%	0.003*	2 (2.2)	2 (1.2)	18%	0.07	2 (1.3)	2 (1.3)	0%	1.00

VAS – visual analogue scale, VMS – verbal multidimensional scoring system; * significant

Table 5. Statistical analysis of VAS and VMS scores: between-group comparison after the treatment

Characteristics	Kruskal-Wallis test with post-hoc test			
	Group A	Group A	Group A	Between-group p
VAS (mean ± *SD*)	3.7 ± 1.27	5.6 ± 1.12	6.8 ± 1.47	< 0.001*
VMS (median) (25^{th}, 75^{th})	0 (0.1)	2 (1.2)	2 (1.3)	< 0.001*

Post-hoc test				
			Difference	p
VAS	Group A	Group B	1.82	0.003*
		Group C	3.09	< 0.001*
	Group B	Group C	1.27	0.07
VMS	Group A	Group B	1.36	< 0.001*
		Group C	1.72	< 0.001*
	Group B	Group C	0.36	0.38

VAS – visual analogue scale, VMS – verbal multidimensional scoring system; * significant

reducing pain severity and painful menstrual cramps caused by the decrease in blood flow to the uterus during primary dysmenorrhoea [28, 29]. Another hypothesis states that during exercises, the level of endorphin secretion increases, thus raising the pain threshold [30]. In addition, stretching exercises raise flexibility and release the tension from the muscles surrounding the pelvic area, including the uterine muscles, thus decreasing the pain and backache caused by muscle tension during dysmenorrhoea [13, 31]. Also, the findings of the present study with reference to decreasing pain intensity and diminishing the amount of medication are consistent with the observations by Shahr-Jerdy et al. [16] and Motahari-Tabari et al. [17], who demonstrated a statistically significant decrease in pain intensity, as well as the duration and amount of medication intake for the pain of dysmenorrhoea in young females in response to stretching exercise.

Moreover, the findings of the current study on the positive impact of supervised active stretching exercises on improving menstruation characteristics, including reduction of the dysmenorrhoea severity and the analgesic requirement, in young females with primary dysmenorrhoea are consistent with the observations by Motahari-Tabari et al. [17]. They found a significant decrease in the analgesic consumption in the exercise group and suggested that stretching exercises had a long-term effect on pain intensity and duration and thus could be used to reduce the amount of analgesic consumption in females with primary dysmenorrhoea.

Among the plausible explanations for these findings is that performing exercises is effective in minimizing stress, which plays a crucial role in the intensity of dysmenorrhoea by raising the sympathetic activity and therefore increasing uterine contraction and menstruation pain. So, in response to physical activity, all aspects of quality of life – physical, social, and emotional – will be improved [32]. Additionally, the release of endorphins could be enhanced by performing physical activity [33–35]. In the current study, the superiority of the supervised active stretching exercises compared with the home-based program can be attributed to the accuracy of the exercises done by the participants as they were guided and constantly corrected by the supervisors' instructions.

The findings of this study are contradicted by those by Blakey et al. [36], who concluded that exercises exhibited no relationship with decreasing symptoms of primary dysmenorrhoea. However, their study relied on participants' responses to a questionnaire to determine the amount and type of physical activity they performed, and the individuals pointed at different types of sports and exercise intensities, which might not have a direct effect on the possible causes of primary dysmenorrhoea. When interpreting the results of other studies that failed to prove the correlation of pain reduction and exercises, consideration should be given to differences in exercise parameters and some methodology issues, as most studies were retrospective and did not control the factors of the prevalence of primary dysmenorrhoea (i.e. parity and age) [30]. In this study, factors related to primary dysmenorrhoea prevalence were considered in the inclusion criteria, as well as the specified parameters of the intervention in the therapeutic procedures.

Limitations

The current work has some limitations: the long-term effect after stopping training was not determined, the sample size was small, the duration of the training period was short, and the impact of exercises on the psychological state of the participants was not measured. Therefore, further research with a large sample size is recommended and should consider the long-term effect of stretching exercises on primary dysmenorrhoea and the impact of stretching exercises on the psychological state in females with primary dysmenorrhoea.

Conclusions

The results presented in the current study may facilitate improvements in the growing evidence that promotes practising active stretching exercises, either supervised or in a home-based program, as a safe non-pharmacological alternative for pain management in primary dysmenorrhoea. For improving menstruation characteristics, supervised active stretching exercises seem to be effective.

We believe that these types of programs should be introduced in schools in order to reduce the rate of absenteeism, not only in physical education.

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Disclosure statement

No author has any financial interest or received any financial benefit from this research.

Conflict of interest

The authors state no conflict of interest.

References

1. Ameade EPK, Amalba A, Mohammed BS. Prevalence of dysmenorrhea among university students in Northern Ghana; its impact and management strategies. BMC Womens Health. 2018;18:39; doi: 10.1186/s12905-018-0532-1.
2. Ryan SA. The treatment of dysmenorrhea. Pediatr Clin North Am. 2017;64(2):331–342; doi: 10.1016/j.pcl.2016.11.004.
3. Mohamed HE, Mansour SE. The effect of dysmenorrhea on quality of life of technical secondary schools girls. Med J Cairo Univ. 2013;81:83–90.
4. Bernardi M, Lazzeri L, Perelli F, Reis FM, Petraglia F. Dysmenorrhea and related disorders. F1000Res. 2017;6:1645; doi: 10.12688/f1000research.11682.1.
5. Kamel DM, Tantawy SA, Abdelsamea GA. Experience of dysmenorrhea among a group of physical therapy students from Cairo University: an exploratory study. J Pain Res. 2017;10:1079–1085; doi: 10.2147/JPR.S132544.
6. Harada T. Dysmenorrhea and endometriosis in young women. Yonago Acta Med. 2013;56(4):81–84.
7. Rapkin AJ, Howe CN. Pelvic pain and dysmenorrhea. In: Berek JS (ed.), Berek & Novak's gynecology, 14th ed. Philadelphia: Lippincott Williams and Wilkins; 2006; 505–540.
8. Morrow C, Naumburg EH. Dysmenorrhea. Prim Care. 2009;36(1):19–32; doi: 10.1016/j.pop.2008.10.004.
9. Khan KS, Champaneria R, Latthe PM. How effective are non-drug, non-surgical treatments for primary dysmenorrhoea? BMJ. 2012;344:e3011; doi: 10.1136/bmj.e3011.
10. Iorno V, Burani R, Bianchini B, Minelli E, Martinelli F, Ciatto S. Acupuncture treatment of dysmenorrhea resistant to conventional medical treatment. Evid Based Comple-

ment Alternat Med. 2008;5(2):227–230; doi: 10.1093/ecam/nem020.
11. Boguszewski D, Borowska J, Szymańska A, Adamczyk JG, Lewandowska M, Białoszewski D. Effectiveness of kinesiotaping for the treatment of menstrual pain. Physiother Quart. 2020;28(4):20–24; doi: 10.5114/pq.2020.96230.
12. Aboushady RM-N, El-Saidy TMK. Effect of home based stretching exercises and menstrual care on primary dysmenorrhea and premenstrual symptoms among adolescent girls. IOSR J Nurs Health Sci. 2016;5(2):47–57; doi: 10.9790/1959-0502054757.
13. Patel NS, Tanna T, Bhatt S. Effect of active stretching exercises on primary dysmenorrhea in college going female students. Indian J Physiother Occup Ther. 2015;9(3):72; doi: 10.5958/0973-5674.2015.00099.4.
14. Stefanov T, Vekova A, Bonova I, Tzvetkov S, Kurktschiev D, Blüher M, et al. Effects of supervised vs non-supervised combined aerobic and resistance exercise programme on cardiometabolic risk factors. Cent Eur J Public Health. 2013;21(1):8–16; doi: 10.21101/cejph.a3801.
15. Fennell C, Peroutky K, Glickman EL. Effects of supervised training compared to unsupervised training on physical activity, muscular endurance, and cardiovascular parameters. MOJ Orthop Rheumatol. 2016;5(4):00184; doi: 10.15406/mojor.2016.05.00184.
16. Shahr-Jerdy S, Hosseini RS, Gh ME. Effects of stretching exercises on primary dysmenorrhea in adolescent girls. Biomed Hum Kinet. 2012;4:127–132; doi: 10.2478/v10101-012-0024-y.
17. Motahari-Tabari N, Shirvani MA, Alipour A. Comparison of the effect of stretching exercises and mefenamic acid on the reduction of pain and menstruation characteristics in primary dysmenorrhea: a randomized clinical trial. Oman Med J. 2017;32(1):47–53; doi: 10.5001/omj.2017.09.
18. Arafa AE, Senosy SA, Helmy HK, Mohamed AA. Prevalence and patterns of dysmenorrhea and premenstrual syndrome among Egyptian girls (12–25 years). Middle East Fertil Soc J. 2018;23(4):486–490; doi: 10.1016/j.mefs.2018.01.007.
19. Chiu M-H, Hsieh H-F, Yang Y-H, Chen H-M, Hsu S-C, Wang H-H. Influencing factors of dysmenorrhoea among hospital nurses: a questionnaire survey in Taiwan. BMJ Open. 2017;7(12):e017615; doi: 10.1136/bmjopen-2017-017615.
20. Bano R. Anemia and its impact on dysmenorrhea and age at menarche. IOSR J Pharm Biol Sci. 2012;4(2):21–24; doi: 10.9790/3008-0422124.
21. Hawker GA, Mian S, Kendzerska T, French M. Measures of adult pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire (MPQ), Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF-36 BPS), and Measure of Intermittent and Constant Osteoarthritis Pain (ICOAP). Arthritis Care Res. 2011;63(Suppl. 11):S240–S252; doi: 10.1002/acr.20543.
22. Direkvand-Moghadam A, Khosravi A. Evaluating Shirazi (Thymus vulgaris) on menstrual pain using verbal multidimensional scoring system (VMS). Afr J Pharm Pharmacol. 2012;6(39):2761–2766; doi: 10.5897/AJPP11.818.
23. Kisner C, Colby LA. Therapeutic exercise: foundations and techniques. Philadelphia: F.A. Davis Company; 2007.
24. Andersch B, Milsom I. An epidemiologic study of young women with dysmenorrhea. Am J Obstet Gynecol. 1982;144(6):655–660; doi: 10.1016/0002-9378(82)90433-1.
25. Matthewman G, Lee A, Kaur JG, Daley AJ. Physical activity for primary dysmenorrhea: a systematic review and meta-analysis of randomized controlled trials. Am J Obstet Gynecol. 2018;219(3):255.e1–255.e20; doi: 10.1016/j.ajog.2018.04.001.
26. Gamit KS, Sheth MS, Vyas NJ. The effect of stretching exercise on primary dysmenorrhea in adult girls. Int J Med Sci Public Health. 2014;3(5):549–551; doi: 10.5455/ijmsph.2014.210220142.
27. Vaziri F, Hoseini A, Kamali F, Abdali K, Hadianfard M, Sayadi M. Comparing the effects of aerobic and stretching exercises on the intensity of primary dysmenorrhea in the students of universities of Bushehr. J Family Reprod Health. 2015;9(1):23–28.
28. Onur O, Gumus I, Derbent A, Kaygusuz I, Simavli S, Urun E, et al. Impact of home-based exercise on quality of life of women with primary dysmenorrhoea. S Afr J Obstet Gynaecol. 2012;18(1):15–18.
29. Izzo A, Labriola D. Dysmenorrhoea and sports activities in adolescents. Clin Exp Obstet Gynecol. 1991;18(2):109–116.
30. Daley AJ. Exercise and primary dysmenorrhoea: a comprehensive and critical review of the literature. Sports Med. 2008;38(8):659–670; doi: 10.2165/00007256-200838080-00004.
31. Kanwal R, Masood T, Awan WA, Baig MS, Babur MN. Effectiveness of stretching exercises in symptomatic and asymptomatic phase in primary dysmenorrhoea. Pak J Physiol. 2017;13(2):6–10.
32. Zahradnik H-P, Hanjalic-Beck A, Groth K. Nonsteroidal anti-inflammatory drugs and hormonal contraceptives for pain relief from dysmenorrhea: a review. Contraception. 2010;81(3):185–196; doi: 10.1016/j.contraception.2009.09.014.
33. McGovern CE, Cheung C. Yoga and quality of life in women with primary dysmenorrhea: a systematic review. J Midwifery Womens Health. 2018;63(4):470–482; doi: 10.1111/jmwh.12729.
34. Gill DL, Hammond CC, Reifsteck EJ, Jehu CM, Williams RA, Adams MM, et al. Physical activity and quality of life. J Prev Med Public Health. 2013;46(Suppl. 1):28–34; doi: 10.3961/jpmph.2013.46.S.S28.
35. Chung F-F, Yao C-CC, Wan G-H. The associations between menstrual function and life style/working conditions among nurses in Taiwan. J Occup Health. 2005;47(2):149–156; doi: 10.1539/joh.47.149.
36. Blakey H, Chisholm C, Dear F, Harris B, Hartwell R, Daley AJ, et al. Is exercise associated with primary dysmenorrhoea in young women? BJOG. 2010;117(2):222–224; doi: 10.1111/j.1471-0528.2009.02220.x.