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Physical exercise and curcumin supplementation have the potential to reduce pain intensity in women with primary dysmenorrhea: Systematic review

Ćwiczenia fizyczne i suplementacja kurkuminy a redukcja intensywności bólu u kobiet z bolesnym miesiączkowaniem: Przegląd systematyczny

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Abstract

This review aims to highlight the potential of physical exercise and curcumin supplementation in reducing pain intensity in women with primary dysmenorrhea. This research uses a systematic review method. Studies were identified through Proquest, Pubmed, ScienceDirect, and PMC Europe electronic databases. The inclusion criteria in this study were international journals that focused on discussing aerobic exercise, stretching, core strengthening, Zumba, and FITT as treatment methods for PD, as well as articles that discussed the efficacy of curcumin as a PD treatment. The exclusion criteria in this study were international journals that had been published in the last 5 years and articles that were not relevant to PD treatment. For standard operationalization, this Study follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Based on the results of the review, physical exercise such as aerobic exercise, treadmill, Zumba, squatting exercise, and therapeutic exercise which is done regularly has the potential to reduce the intensity of menstrual pain. Furthermore, curcumin supplementation at a dose of 500-1000 mg can help reduce complaints of primary dysmenorrhea by inhibiting the cyclooxygenase (COX) reaction so that it can reduce inflammation and inhibit uterine contractions which cause menstrual pain.

Keywords

physical exercise, curcumin, inflammation, primary dysmenorrhea

Streszczenie

Celem tego przeglądu jest podkreślenie potencjału ćwiczeń fizycznych i suplementacji kurkuminy w zmniejszaniu intensywności bólu u kobiet z pierwotnym bolesnym miesiączkowaniem. W badaniu tym zastosowano metodę przeglądu systematycznego. Badania zidentyfikowano za pomocą elektronicznych baz danych Proquest, Pubmed, ScienceDirect i PMC Europe. Kryteriami włączenia do tego badania były czasopisma międzynarodowe skupiające się na omówieniu ćwiczeń aerobowych, rozciągania, wzmacniania mięśni tułowia, Zumby i FITT jako metod leczenia choroby Parkinsona, a także artykuły omawiające skuteczność kurkuminy w leczeniu choroby Parkinsona. Kryteriami wykluczenia z tego badania były czasopisma międzynarodowe opublikowane w ciągu ostatnich 5 lat oraz artykuły nieistotne dla leczenia PD. W przypadku standardowej operacjonalizacji w niniejszym badaniu zastosowano preferowane elementy sprawozdawcze dla przeglądów systematycznych i metaanaliz (PRISMA). Z wyników przeglądu wynika, że regularne ćwiczenia fizyczne, takie jak aerobik, bieżnia, zumba, przysiady i ćwiczenia terapeutyczne mogą potencjalnie zmniejszyć intensywność bólu menstruacyjnego. Co więcej, suplementacja kurkuminą w dawce 500-1000 mg może pomóc w zmniejszeniu dolegliwości związanych z pierwotnym bolesnym miesiączkowaniem poprzez hamowanie reakcji cyklooksygenazy (COX), dzięki czemu może zmniejszyć stan zapalny i hamować skurcze macicy powodujące ból menstruacyjny.

Słowa kluczowe

ćwiczenia fizyczne, kurkumina; zapalenie, pierwotne bolesne miesiączkowanie

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Introduction

Pain that occurs during or shortly after menstruation in the lower abdomen is called Primary Dysmenorrhea (PD) [1]. In general, the pain also spreads to the hips and thighs without being accompanied by other pathological conditions after several examinations [2]. Primary dysmenorrhea can begin several hours before or at the start of menstruation, and reaches its peak when blood flow becomes heaviest on the first or second day of menstruation [1]. The pathophysiology of PD depends on an increase in prostaglandin (PG) F2-alpha, a cyclooxygenase (COX-2), causing hypertonus and vasoconstriction in the myometrium, resulting in ischemia and pain in the lower abdomen. Strong and prolonged contractions in the uterine wall, high levels of prostaglandin hormones, and the widening of the uterine wall during menstrual bleeding result in pain during menstruation. [3].

Based on world data, the incidence of primary dysmenorrhea reaches 45% in fertile women and the highest incidence occurs in women aged 13-17 years [4]. The common approach to managing pain due to primary dysmenorrhea has been through the use of non-steroidal anti-inflammatory drugs (NSAIDs) [5, 6]. However, prolonged and frequent use of NSAIDs can have a significant impact on health.

Alternative methods such as regular physical exercise according to Frequency, Intensity, Time and Type (FITT) are able to increase blood flow to the reproductive organs, blood capillaries in the abdominal muscles so that they experience vasodilation and increased permeability and can stimulate β endorphin which acts as a non-analgesic. specifically, then reduces the duration and level of dysmenorrhea pain [7]. Apart from that, curcumin, which is a natural ingredient contained in turmeric, has anti-inflammatory, antioxidant, antitumor, anticancer and antimicrobial properties [8], [9]. Curcumin can inhibit the cyclooxygenase (COX) reaction so that it can inhibit and reduce inflammation and will reduce and inhibit uterine contractions which cause menstrual pain [10]. Traditionally, curcumin is often used by people in various countries to treat various types of diseases, such as diseases caused by parasitic microbes, insect bites, eye diseases, smallpox, stomach aches (diarrhea, constipation, bloating), digestive disorders, liver disorders, asthma, eliminates itching, skin diseases, reduces pain and soreness in rheumatoid arthritis sufferers [11]. In this regard, it is necessary to know the potential of curcumin and physical exercise in reducing pain intensity in women with primary dysmenorrhea. These issues provide us with the opportunity to discuss them in depth through a systematic review.

This review aims to highlight the potential of curcumin and physical exercise in reducing pain intensity in women with primary dysmenorrhea.

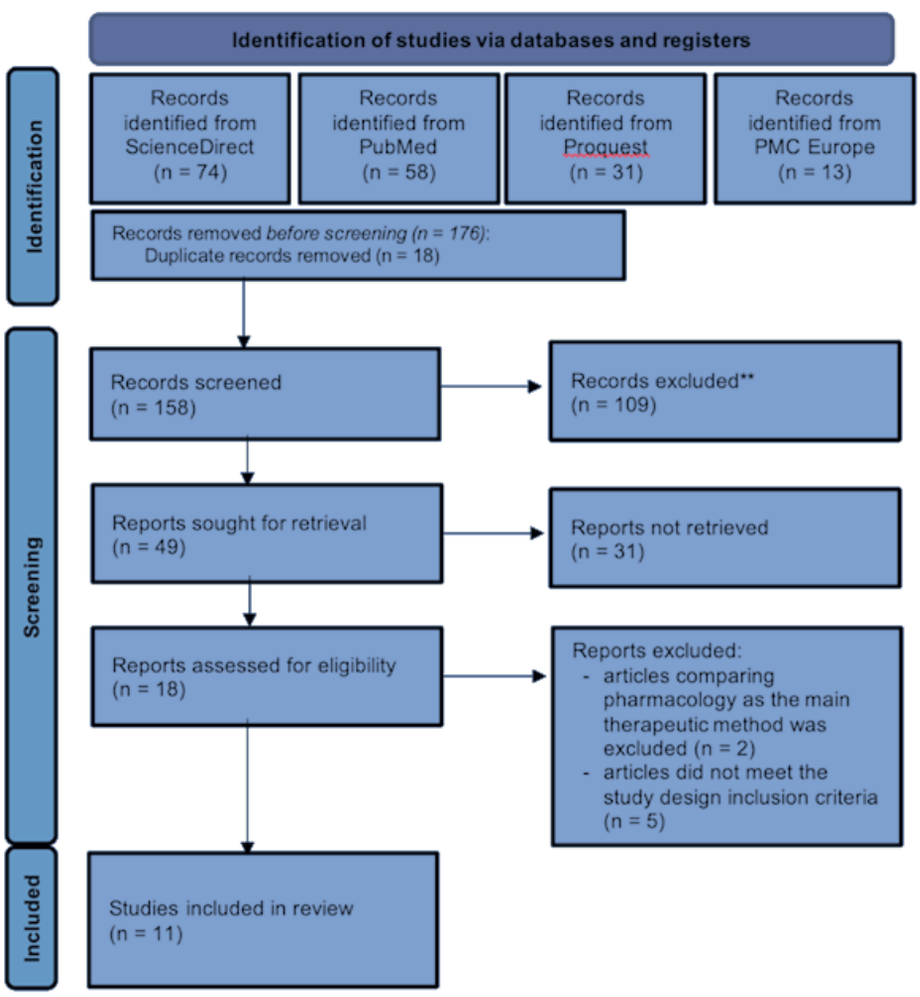

Figure 1. Diagram preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews

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Methods

This research uses a systematic review method. Studies were identified through Proquest, Pubmed, ScienceDirect, and PMC Europe electronic databases. We use the PRISMA checklist as a writing guide to ensure all steps are carried out correctly. The inclusion criteria in this study were international journals that focused on discussing aerobic exercise, stretching, core strengthening, Zumba, and FITT as treatment methods for PD, as well as articles that discussed the efficacy of curcumin as a PD treatment. The exclusion criteria in this study were international journals that had been published in the last 5 years and articles that were not relevant to PD treatment. The keywords used in the search were physical exercise, curcumin, and primary dysmenorrhea. A total of 176 articles (74 in ScienceDirect, 58 in PubMed, 31 in Proquest, and 13 in PMC Europe) were identified. After reading it, several articles did not meet the inclusion criteria because some compared pharmacological ones, were not intended for the treatment of PD, etc. So 11 articles were selected and can be seen in table 1. Based on the two alternative solutions selected, 7 articles were found that focused on physical exercise in reducing PD and 4 articles discussed the content of curcumin which can reduce PD.

Table 1. Results of review of the effects of physical activity on primary dysmenorrhea

Review Year	Title	Design, Respondent	Sample characteristics
Lorzadeh, Kazemirad and Kazemirad, 2021 [12]	The effect of corrective and therapeutic exercises on bleeding volume and severe menstrual pain in non-athletic women	This type of quasi-experimental research, involved adolescent girls enrolled at Lorestan National University in Lorestan, Iran.	In the intervention group, there was a significant reduction in the severity of menstrual pain (p-value < 0.001). In this group, all subjects experienced menstrual pain before exercise. After three months of exercise, only three of all subjects (10%) experienced menstrual pain, this shows that the exercise reduced menstrual pain in 90% of subjects. One month after cessation of exercise, menstrual pain returned in 30% of subjects, indicating a significant effect of corrective exercise on the severity of menstrual pain ($p < 0.001$).
Kannan, Cathy M Chapple, et al., 2019 [13]	Effectiveness of a treadmill based aerobic exercise intervention on pain, daily functioning, and quality of life in women with primary dysmenorrhea: A randomized controlled trial	This type of research is a randomized controlled trial. 70 women with primary dysmenorrhea were included in this study.	The experimental group underwent supervised aerobic exercise for 4 weeks followed by unsupervised home exercise for the next 6 months. Exercise provided statistically significant benefits in the first month for pain quality (Pain Rating Index) and pain intensity (both $p < 0.05$) compared with the control group. These benefits were maintained at months 4 and 7 (both $p < 0.01$). The benefit at 7 months for pain intensity was also clinically beneficial, with an average reduction in pain intensity of 21 mm at a VAS of 100 mm. at 7 months ($p < 0.01$).
Samy et al., 2019 [14]	The Effect of Zumba Exercise on Reducing Menstrual Pain in Young Women with Primary Dysmenorrhea: A Randomized Controlled Trial	This type of research is a randomized controlled trial. 98 women with primary dysmenorrhea were included in this study.	The intervention group was given 16 60 minute Zumba fitness classes during 2 consecutive menstrual cycles (8 weeks, twice a week). They start on the third day of the menstrual cycle each cycle. The duration of each class is 1 hour, and a minimum recovery period of 48 hours is taken between classes. The results of comparing the intervention group and the control group showed a significant difference in pain intensity seen in the second and third months compared to the first month in the Zumba group ($P = 0.001$) and also a significant difference seen after regular exercise for three menstrual cycles ($P = 0.001$).
Song and Kim, 2023 [15]	Effects of Pilates on Pain, Physical Function, Sleep Quality, and Psychological Factors in Young Women with Dysmenorrhea: A Preliminary Randomized Controlled Study	This type of research is a randomized controlled trial. 30 women with primary dysmenorrhea were randomly selected to be included in this study.	The intervention group was given a Pilates training intervention with a total of 24 Pilates sessions for 12 weeks. The control group did not receive any intervention during the 12-week period. The results showed that in the Pilates group, VAS ($p < 0.001$), CMSS severity ($p < 0.001$) and frequency ($p < 0.01$), PSST symptoms ($p < 0.001$), and PSST functional impairment ($p < 0.01$) decreased significantly after the intervention with a large effect size. Meanwhile, in the control group, there were no significant changes.
Kirca and Celik, 2023 [16]	Effect of progressive relaxation exercises on primary dysmenorrhea in Turkish students: A randomized prospective controlled trial Effect of different squatting	This experimental research is a single-blind randomized controlled study. The research sample consisted of 510 female students from 750 students at the Faculty of Health Sciences who were willing to fill out the data collection tool and 194 samples were selected according to the inclusion criteria.	The research control group (CG) consisted of 60 students while the experimental group (EG) consisted of 64 students. Progressive relaxation exercises were carried out independently via compact disc (CD) by participants during two menstrual cycles. Descriptive information form, visual analog scale (VAS) and dysmenorrhea monitoring form (DMF) were used for data collection. The difference between the mean VAS scores on the final measurements of students in EG and CG showed statistically significant results. It appears that the pain level of students in EG decreased after exercising, while for students in CG there was no significant change in pain level ($t = -10.720$, $p = 0.000$).

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Review Year	Title	Design, Respondent	Sample characteristics
Yosri et al., 2022 [17]	exercises on menstrual aspects, pelvic mechanics and uterine circulation in primary dysmenorrhoea: a randomised controlled trial	This research is a randomized controlled trial. A total of 120 women with primary dysmenorrhoea were included in this study.	A total of 120 women with primary dysmenorrhoea were assigned to group (A), which received the yoga protocol, and groups (B, C & D), each receiving the yoga protocol adding modified wall squats, sumo squats, or deep squats. There was a significant reduction in pain intensity in groups B & C (effect size = 3.97 & 5.89 respectively), compared with group A (effect size = 3.68), and in group C (effect size = 5, 89) compared with group D (effect size = 3.94), pain subscale in groups B, C & D (effect size = 1.69, 3.3 & 3.41 respectively), compared with group effect size = 2.47), water retention subscale in group D effect size 0.90 compared to group A (effect size = 0.41) and in total questionnaire score in groups C & D (effect size = 2.3 respectively & 2.46) when compared with group A (effect size = 1.94). So the research results show that squats added to yoga practice are more effective than yoga alone in reducing menstrual pain and pressure.
Yildiz and Acaroğlu, 2022 [18]	The Effect of Massage and Progressive Relaxation Exercises on Pain Intensity and Menstrual Symptoms in Students With Primary Dysmenorrhea A Randomized Controlled Trial	This research is a randomized controlled trial. A total of 97 female students with primary dysmenorrhoea were involved in this study.	A total of 97 female students, 50 in the intervention group and 47 in the control group were involved in this randomized controlled study with a pretest-posttest design. Massage and progressive relaxation exercises are self-administered practices that are easy to implement, have no side effects, and have beneficial effects on pain, sweating, fatigue, and gastrointestinal and central nervous system symptoms. So it can be said that the simultaneous application of massage and progressive relaxation exercises can be more effective in reducing menstrual symptoms than applying them separately..

Table 2. Results of review of the effects of curcumin on primary dysmenorrhea

Review Year	Title	Design, Respondent	Sample characteristics
Bahrami et al., 2021 [19]	Effects of curcumin on menstrual pattern, premenstrual syndrome, and dysmenorrhea: A triple-blind, placebo-controlled clinical trial	This type of research is a randomized controlled trial. 124 women suffering from PMS and dysmenorrhea were included in this study.	Women suffering from PMS and dysmenorrhea were randomly assigned to a curcumin intervention group (n = 62), or placebo (n = 62). Each subject received one capsule (500 mg curcuminoids, or placebo) daily, from 7 days before to 3 days postmenstruation for three consecutive menstrual cycles. Participants recorded the severity of PMS, or dysmenorrhea using the Premenstrual Syndrome Screening Tool (PSST) and Visual Analog Scale, respectively. At the end of the trial, PSST scores were significantly lower in the curcumin group (32.5 ± 9.8 vs. 21.6 ± 9.8); and placebo group (31.7 ± 9.4 vs. 23.4 ± 12.8). There was a significant reduction in dysmenorrhea pain in the curcumin and placebo groups (64% and 53.3%, respectively). However, there was a decrease in pain in the curcumin group and placebo group, both of which there was a reduction in pain. Therefore, further studies are needed with larger samples, using high doses of curcumin for longer periods of time, and possibly in combination therapy.
Bahrami et al., 2022 [20]	Effects of curcumin-piperine supplementation on systemic immunity in young women with premenstrual syndrome and dysmenorrhea: A randomized clinical trial	This type of research is a randomized controlled trial. 80 women with primary dysmenorrhea were included in this study.	A sample of 80 patients was included for this triple-blind, placebo-controlled clinical trial. Participants were randomly allocated to curcumin (n = 40) and control groups (n = 40). Each participant received one capsule (500 mg curcuminoids plus piperine, or placebo) daily, from 7 days before to 3 days after menstruation for three consecutive menstrual cycles. The results showed that serum IgE, IL-10 and IL-12 levels were measured using an ELISA kit. No significant differences were found between the two groups at baseline, including: age, BMI, and food intake (P > 0.05). Curcumin + piperine treatment was associated with a significant reduction in mean serum IgE levels [from 223.6 ± 258.7 IU/mL to 161.3 ± 240.7; P = 0.001]; but there was no significant change in the placebo group (P = 0.12).
Agarwal and Chaudhary, 2023 [21]	Effect of Turmeric–Boswellia–Sesame Formulation in Menstrual Cramp Pain Associated with Primary Dysmenorrhea—A Double-Blind, Randomized, Placebo-Controlled Study	This type of research is a randomized controlled trial. 60 women with primary dysmenorrhea were included in this study.	60 women with primary dysmenorrhea were randomly divided into two groups of 30 participants each, and given a turmeric-boswellia-sesame formulation (treatment) or placebo. Participants were advised to take two 500 mg soft gel capsules as a single dose of the allocated study intervention (total dose 1000 mg) when their menstrual pain reached a 5 or above on the numerical rating scale (NRS). The intensity and pain relief of menstrual cramps were evaluated every 30 minutes post-dose for up to 6 hours. The results showed a promising role of the turmeric-boswellia-sesame formulation in relieving menstrual pain compared with placebo. The mean total pain relief (TOTPAR) in the treatment group (18.9 ± 0.56) was found to be 12.6 times better than the placebo group (1.5 ± 0.39). NRS analysis showed that there was a statistically significant difference in pain intensity between the treatment and placebo groups ($p < 0.001$) at each time point. In addition, the total difference in pain intensity at 6 hours (SPID6) in the treatment group (34.32 ± 1.41) showed a significant difference ($p < 0.0001$) and was 20.19 times better when compared with placebo (1, 7 ± 0.56). Based on the research results, the turmeric-boswellia-sesame formulation showed remarkable menstrual pain relief compared to placebo.
Utami, Damayanti and Rodiah, 2020 [22]	The Effectiveness of Curcuma Longa Drink in Decreasing the Intensity of Dysmenorrhea	This type of experimental research is pre-test post-test group design. 32 women with primary dysmenorrhea were included in this study.	Respondents were divided into 2 groups, namely the home industry Curcuma longa drink group and the Curcuma longa drink group by researchers. The results of the study showed that there was a significant difference in giving Curcuma longa drinks to reducing dysmenorrhea pain in young women ($p \leq 0.001$).

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Discussion

Primary dysmenorrhea usually begins when a woman experiences her first menstruation with symptoms of pain in the lower abdomen and is accompanied by a feeling of nausea and diarrhea [16]. The pathophysiology of primary dysmenorrhoea is an increase in the hormone Prostaglandin F2α (PGF2α). Prostaglandin F2α (PGF2α) is a potent stimulant of myometrial contractions and has a vasoconstrictive effect on blood vessels [4]. This increase in prostaglandin levels will result in increased myometrial tone and excessive uterine contractions which will cause pain during menstruation or dysmenorrhea [1].

Furthermore, physical exercise is useful for increasing muscle strength, endurance, and flexibility, which can enhance blood flow throughout the body, including the lower abdomen. Blood capillaries in the abdominal muscles experience vasodilation, increasing their permeability and stimulating β-endorphin, which acts as a non-specific analgesic, thereby reducing the duration and intensity of dysmenorrhea pain [23]. Endorphins are produced in the brain and spinal cord [24]. This hormone functions as a natural sedative, causing a feeling of comfort. Physical exercise has been proven to increase endorphin levels four to five times in the blood, so the more physical exercise you do, the higher your endorphin levels will be [25]. When a person does physical exercise, endorphins are produced in the brain which are produced by the pituitary gland. This statement is reinforced by 7 articles reporting that adolescents with PD who do physical exercise such as aerobics, treadmill, Zumba, squatting and therapeutic exercise which is done regularly over a certain period of time has the potential to reduce the intensity of menstrual pain [12, 14–18, 26]. In research (Lorzadeh, Kazemirad and Kazemirad, 2021) [12] stated that providing treadmill-based aerobic exercise intervention for 1 month could significantly reduce PD, in the form of reducing pain intensity by 21 mm at a VAS of 100 mm.

The next alternative is that the properties of curcumin found in turmeric are believed to be able to overcome or cure dysmenorrhoea. The phenolic compound content in turmeric can be used as an antioxidant, analgesic, anti-microbial, anti-inflammatory [8], [9]. More specifically, the curcumine content in turmeric can inhibit the cyclooxygenase (COX) reaction so that it can inhibit and reduce inflammation and will reduce and inhibit uterine contractions which cause menstrual pain [10]. A total of 4 articles mention that Curcumin is one of the best phytochemicals isolated from Curcuma longa L., which is a fat-soluble natural compound that can treat PD [19–22]. Several studies report that curcumin at doses of 500 mg and 1000 mg can reduce PD [20, 21].

Conclusions

Aerobic physical exercise, treadmill, Zumba, squatting exercise and therapeutic exercise carried out regularly for more than 3 months have been proven to reduce the intensity of menstrual pain. Furthermore, curcumin supplementation at a dose of 500-1000 mg can help reduce symptoms of primary dysmenorrhea by inhibiting the cyclooxygenase (COX) reaction so that it can reduce inflammation and inhibit uterine contractions which cause menstrual pain.

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