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EFFECTS OF PHYSICAL EXERCISE ON PRIMARY DYSMENORRHEA. SYSTEMATIC REVIEW

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Abstract. Primary dysmenorrhea (PD) is the most common menstrual disorder and is defined as painful menstruation. This health problem reduces the quality of life of more than 70% of women who suffer from it, so the main objectives of this review were to assess whether physical exercise was safe for these women and, knowing its effects on PD, compare the different exercises or training methods by analysing which are the most effective. In this paper, articles from the PubMed database were reviewed, selecting those written in Spanish and English that were no more than 5 years old and choosing intervention studies to perform the analysis. In addition, the information was completed with the website of The American College of Obstetricians and Gynecologists. Interventions pointed to physical exercise as a positive treatment for PD. The most significant improvements were obtained in the pain and intensity of menstruation. There were also reductions in menstrual distress, duration of pain and painkillers consumed, as well as improvements in quality of life. It is concluded that regular physical exercise is a safe and effective method to reduce the symptoms caused by PD. Long-term exercise will also have beneficial effects in the long run, further reducing these symptoms and improving the overall health of the person. In addition, it should be noted that this treatment does not generate side effects in the body. Aerobic exercise seems to be the most effective training method for dysmenorrhea symptoms, followed by some stretching exercises or yoga.

Keywords: Menstruation, menstrual pain, dysmenorrhea symptoms, training, health.

EFECTOS DEL EJERCICIO FÍSICO EN LA DISMENORREA PRIMARIA. REVISIÓN SISTEMÁTICA

Resumen. La dismenorrea primaria (DP) es el trastorno menstrual más común y se define como menstruación dolorosa. Este problema de salud reduce la calidad de vida de más del 70% de las mujeres que lo padecen, por lo que los principales objetivos de esta revisión fueron evaluar si realizar ejercicio físico era seguro para estas mujeres y, conociendo sus efectos en la DP, comparar los distintos ejercicios o

métodos de entrenamiento analizando cuáles son los más eficaces. En este trabajo se revisaron artículos procedentes de la base de datos PubMed, seleccionando aquellos escritos en castellano e inglés, que no tuviesen más de 5 años y escogiendo estudios de intervención para realizar el análisis. Además, se completó la información con la página web del Colegio Americano de Obstetras y Ginecólogos. Las intervenciones señalaron al ejercicio físico como un tratamiento positivo para la DP. Las mejoras más significativas se obtuvieron en el dolor e intensidad de la menstruación. También hubo reducciones en la angustia menstrual, la duración del dolor y en los analgésicos consumidos, así como mejoras en la calidad de vida. Se concluye que el ejercicio físico realizado de una forma regular es un método seguro y eficaz para reducir los síntomas producidos por la DP. La práctica prolongada en el tiempo también tendrá efectos beneficiosos a largo plazo, reduciendo aún más estos síntomas y mejorando la salud en general de la persona. Además, cabe destacar que este tratamiento no genera efectos secundarios en el organismo. El ejercicio aeróbico parece ser el método de entrenamiento más efectivo para los síntomas dismenorreicos, seguido de algunos ejercicios de estiramiento o el yoga.

Palabras clave: Menstruación, dolor menstrual, síntomas dismenorreicos, entrenamiento, salud.

Introduction

The term *dysmenorrhea* derives from the Greek terms *dys* (difficult), *mens* (month), and *rhoia* (flow); it means difficult menstrual flow and is defined as painful menstruation (Carroquino-Garcia et al., 2019). According to the American College of Obstetricians and Gynecologists (ACOG, 2015), dysmenorrhea is pain associated with menstruation, being the most common menstrual disorder. There are two types, primary dysmenorrhea (PD) and secondary dysmenorrhea. PD is defined as menstrual pain in the absence of any organic cause and usually begins within the first 3 years of menarche (first menstrual period) (Armour, Smith, Steel, & Macmillan, 2019). In contrast, secondary dysmenorrhea is caused by a disorder in the reproductive system (ACOG, 2015).

The hallmark symptom of PD is cramping, cramping spasms of cramping pain below the umbilicus. In addition to these cramps, many women experience back and thigh pain, headaches, diarrhea, nausea, and vomiting (Armour, Smith et al., 2019). Cramping is primarily caused by natural chemicals called prostaglandins, generated in the lining of the uterus (ACOG, 2015). These substances stimulate myometrial contractions by reducing uterine blood flow and causing uterine hypoxia. This hypoxia is responsible for the characteristic painful cramping (Armour, Smith, et al., 2019). The pain usually appears just before menstruation begins, as does the level of prostaglandins in the uterine lining. On the first day of the menstrual period, levels are high. As menstruation continues and the lining of the uterus sheds, levels decrease (ACOG, 2015).

Menstrual pain affects about three-quarters of all women during their reproductive life, especially in adolescence and early adulthood (Armour, Smith, et al., 2019). This

prevalence decreases after the age of 25, although according to Carroquino-Garcia et al. (2019), it is associated more with gynecological age than with chronological age. Pain can be classified from moderate to severe (Carroquino-Garcia et al., 2019) and is responsible for decreased quality of life, absenteeism from work or school, decreased participation in sports and social activities, altered pain perception, and sleep problems (Armour, Smith, et al., 2019).

The main goal of dysmenorrhea treatment is to reduce pain and improve the functionality of patients, with nonsteroidal anti-inflammatory drugs and hormone therapy being most common (Garro, Thuel, & Robles, 2019). Armour, Smith, et al. (2019) note that these treatments are effective for many women, but approximately 25% continue to have pain. In addition, they noted that cultural differences also affect the use of analgesics and the oral contraceptive pill, with Chinese women ingesting significantly less than Australian women. Most women manage their symptoms with over-the-counter analgesics (ibuprofen, acetaminophen) and self-care (rest and heat application), rather than seeking medical advice. This is largely due to the perceived lack of effectiveness of these medications or the rejection of their use due to side effects. Armour, Smith, et al. (2019) indicate that there are non-pharmacological self-care techniques, either physical or psychological, that can be practiced by women themselves such as, for example, physical exercise.

It has been observed that physical activity reduces stress, has antinociceptive properties and reduces levels of the prostaglandin subtype most closely related to PD (Matthewman, Lee, Kaur, & Daley, 2018). These same authors comment that it has been an activity recommended by physicians for this health problem since the 1930s and can currently be contemplated in the recommendations to patients provided by ACOG. Furthermore, Carroquino-Garcia et al. (2019) specify that the use of physical exercise as therapy not only improves pain symptoms and mental health, but also quality of life. At the same time they emphasize that it is a low-cost option with no side effects.

Because this health problem reduces the quality of life of more than 70% of women who suffer from it (Carroquino-Garcia et al., 2019), this study aims to corroborate the efficacy of physical exercise as a treatment for PD. Armour, Ee, et al. (2019) warn that this method does not have too much evidence, it is not entirely clear, and even less is known what types of exercise could be beneficial or when they should be performed

(Matthewman et al., 2018). Likewise, Carroquino-Garcia et al. (2019) mention in their article that many women with PD are hesitant to engage in physical exercise out of ignorance or fear that the pain will increase, or simply because of the presence of pain, which negatively affects their lives.

Taking into account all the above information, a series of **objectives** are determined in the present work. The general objectives are:

- Study the most recent scientific information on the effects of physical exercise on PD.
- Evaluate the safety of physical exercise to reduce PD symptoms.

The specific objectives are:

- Determine and compare different training methods to decrease PD symptoms.
- Analyze what effects different training methods have on PD.
- Analyze which methods or exercises are most effective in reducing PD symptoms.

Material and methods

For this review, a search for articles was carried out using the PubMed database and inserting the keywords "*primary dysmenorrhea*" and "*exercise*" between January 15 and February 17, 2020. The selection of articles was carried out using several criteria. The inclusion criteria used were articles from the last 5 years. The exclusion criteria were articles that focused on problems specific to secondary dysmenorrhea and those written in a language other than Spanish or English. In addition, a total of 19 were intervention studies (*Randomized Control Trial*), whose method was the performance of physical exercise in women. Likewise, 5 bibliographic reviews from the last 2 years have been used in order to acquire the most complete and updated information possible on this subject. Finally, for the same purpose, information on PD was acquired from the web page of the American College of Obstetricians and Gynecologists.

Results

Figure 1 represents the flow diagram showing the number of articles that were eliminated in each phase of the literature search. Table 1 shows the studies in which PD was treated by different physical exercise methods.

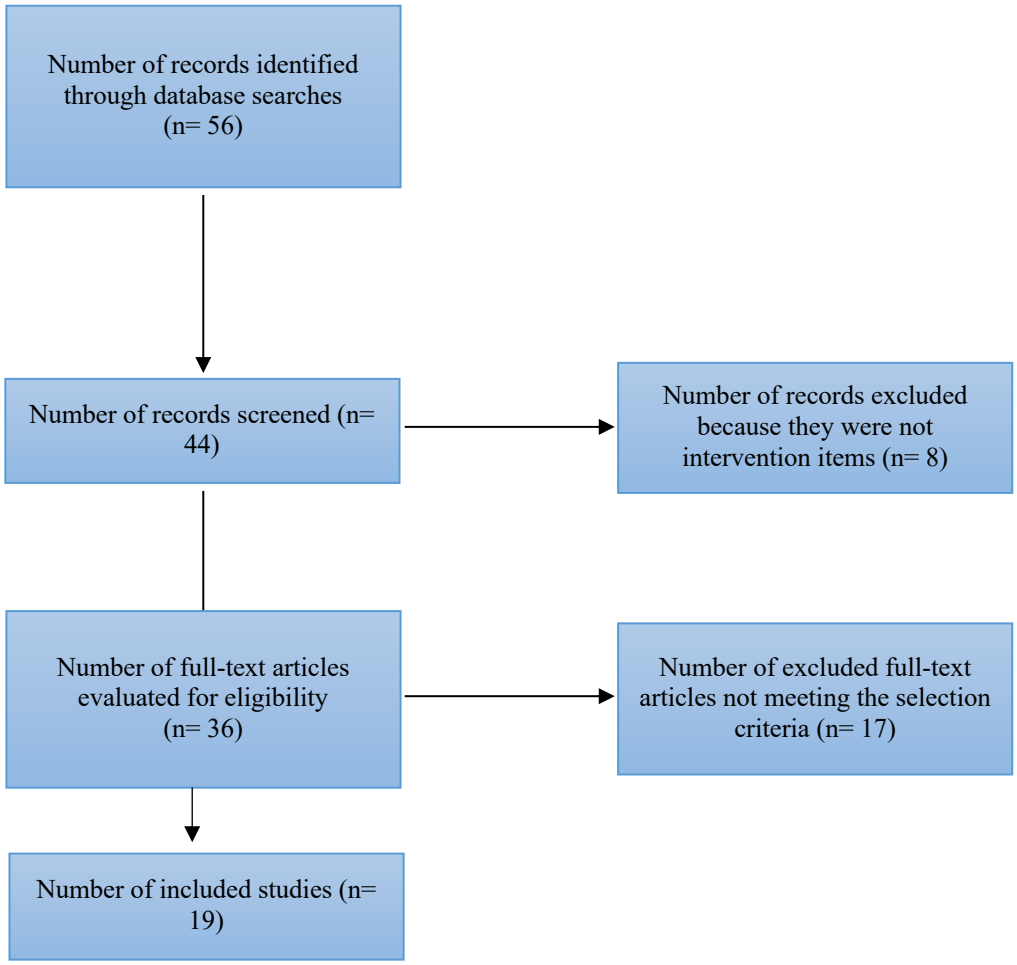

Figure 1. Flow diagram

Table 1

Description of intervention studies

Authors	Participants	Intervention	Results
Aboushady and El-saidy (2016).	N= 80 - 40 women performed stretching exercises (E) - 40 women did not undergo the intervention (CG)	8 weeks - E: 3 days/week, 2 times/day performed 5 stretching exercises at home (20-30') combined with their usual care. - CG: They continued with their usual care.	Instruments for data collection: - Structured interview questionnaire for adolescents - Menstruation Evaluation Questionnaire - Visual analog scale Pain was significantly reduced in E (from 12.5% before intervention to 37.5% after). The symptoms that were most reduced included fatigue, headache, mood changes, constipation, and excessive sweating. The duration of pain and the amount of analgesics consumed also decreased significantly.
Azima et al. (2015).	N= 102 - 34 women received massages (M) - 34 women did isometric exercises (I) - 34 women did not perform any intervention (CG)	8 weeks - M: Effleurage massage with oil on the upper part of the symphysis pubis and the navel in a clockwise direction (each 15'). - I: 5 days/week, 2 times/day 8 isometric exercises repeated 10 times per session.	Instruments for data collection: - Visual analog scale - Duration was measured in hours - Spielberger Questionnaire for Anxiety The intensity and duration of pain decreased significantly in groups M and I, although the reduction was greater in M. In addition, a decrease in the level of anxiety was also observed in M after the third cycle.
Dehnavi et al. (2018).	N= 70 - 35 women did aerobic exercise (AE). - 35 women did not exercise (CG)	8 weeks - AE: 3 days/week. 30' of moderate aerobic exercise with warm up and cool down.	Instruments for data collection: - Questionnaire on personal data and symptoms of dysmenorrhea - Pain intensity scale from 0 (no pain) to 10 (maximum pain) PD pain intensity was significantly reduced in AE compared to CG.
Fallah and Mirfeizi (2018).	N= 78 - 19 women performed stretching (E) - 19 women received massages (M) - 21 women had a combination of the above (C) - 19 women did not exercise (CG)	8 weeks - E: 3 days/week, 2 times/day 20' of 6 stretching exercises on abdomen, pelvis, and groin. - M: 3 days/week, 2 times/day 10' massage. - C: 3 days/wk, 2 times/day 20' of combined massage and stretching exercises.	Instruments for data collection: - Questionnaire on demographics, characteristics of menstrual periods, and medications - Visual analog scale - Mc Gill Pain Intensity Questionnaire Significant decreases in pain, intensity, and bleeding volume were observed in M, as well as in C. In E, duration also decreased. Pain severity decreased more after the intervention in all groups compared to CG, where analgesic use was higher.
Gmoorthy et al. (2018).	N= 30 - 15 women performed stretching exercises (SE) - 15 women did aerobic dance (AD)	8 weeks 3 days/week. - SE: 45' of stretching of the muscles of the whole body. - AD: 45' including 10' warm up and 10' cool down.	Instruments for data collection: - Visual analog scale - Depression, anxiety, and stress scale Both groups showed a reduction in pain and stress, but AD showed a greater reduction in symptoms.
Heidarimoghadam et al. (2019).	N= 86 - 43 women performed exercise based on the FITT protocol (E).	8 weeks - E: F: 8 weeks, 3 days/wk; I: 40-60 FCmax; T: Started with 20' per session until reaching 47'; T: Varying aerobic exercises, the basis being walking (5' warm-up and 5' cool down).	Instruments for data collection: - McGill Pain Scale - Duration was measured in days

	- 43 women did not perform resistance exercise (CG).	- CG: They attended 2 physical education classes once a week and performed group exercises such as volleyball and badminton for 1h 30'.	Sports activities based on a FITT exercise program reduce pain, intensity, and duration of dysmenorrhea compared to CG.
Kannan et al. (2019).	N= 70 - 35 women performed aerobic exercise (AE). - 35 women continued their usual care (CG)	7 months - AE: 3 days/wk. supervised aerobic training (70-85% FC) (including 10' warm-up and 10' cool down with stretching) for 4 weeks. Followed by unsupervised home exercise for 6 months.	Instruments for data collection: - McGill Pain Questionnaire - Health Survey for quality of life - Women's Health Initiative Insomnia Scale - Patient Global Impression of Change scale for participants' perception of improvement. - Attendance at the session to assess adherence In 4 weeks AE significantly improved the quality and intensity of pain. In 7 months significant benefits were maintained for pain, intensity, quality of life, and functionality.
Kanwal et al. (2016).	N= 66 - 33 women underwent TENS (T). - 33 women performed stretching exercises (E)	4 weeks - T: 2 times/day 30' high frequency TENS was applied when pain started. 2 pads on lower abdominal area and 2 on thigh muscles. TENS settings were 100 pulses/second x 100 microseconds. - E: 3 days/week stretching exercises with warm-up and cool-down.	Instruments for data collection: - Visual analog scale - SF 36 for quality of life Pain was significantly reduced in T. In E, functionality was significantly improved. In addition, significant differences were found in some domains of quality of life in T and E. Some of these did not show significant changes probably because of the duration of the intervention.
Kiranmayi et al. (2016).	N= 98 - 50 women participated in an aerobic exercise program (A) - 48 women underwent a stretching program (E).	3 months - A: 3 days/week. 40' session with 1.10' of stretching, 2.20' of aerobic exercises (walking or cycling) with 12-14 Borg scale and 3.10' of relaxation exercises (deep breathing). - E: 3 days/week 2 times/day 4 stretching and strength exercises with 10-20 repetitions.	Instruments for data collection: - Numerical pain rating scale - MOOS Menstrual Distress Questionnaire Pain intensity and menstrual symptoms decreased in A and E, although the results did not have a significant difference between them. However, A had a better score on the menstrual distress questionnaire.
Kirthika et al. (2018).	N= 30 - 15 women did yoga asana (YA) - 15 women performed exercises with fitball (EF)	12 weeks 3 days/week. YA: 60' of yoga asana (Ustrasana, Janusirsasana, and Dhanurasana). - EF: 3 sets of 3 knee and hip flexion-extension exercises with fitball.	Instruments for data collection: - Visual analog scale - MOOS Menstrual Distress Questionnaire Both groups demonstrated a clinical difference in menstrual pain. However, only EF demonstrated a difference in menstrual distress.
Motahari-Tabari et al. (2017).	N= 122 - 61 women did stretching exercises (SE). - 61 women took mefenamic acid (MA).	8 weeks - SE: 3 days/week. 15' session: Warm-up (5') and 6 stretching exercises of the belly and pelvis. - MA: 250 mg/8h until pain relief.	Instruments for data collection: - Questionnaire for demographic and menstrual characteristics - Visual analog scale Greater pain in SE during the first cycle. Greater reduction of pain in SE in the second cycle.
Ortiz et al. (2015)	N= 160 - 83 women underwent a physiotherapy (PP) program - 77 women had no intervention (CG)	3 months - PP: 3 days/week 50' of general and specific stretching, Kegel exercises, jogging, and relaxation exercises.	Instruments for data collection: - Visual analog scale Significant reduction of pain in the second and third cycle in PP compared to CG.

Saleh et al. (2016).	N= 126 - 44 women performed active stretching (AE) - 44 women strengthened their CORE (SC) - 38 women did not intervene (CG)	8 weeks - AE: 3 days/week. 3 times/day 10' of 4 stretching exercises performed at home. - SC: 4 days/week. 3 times/day 20' of 4 exercises to strengthen the CORE.	Instruments for data collection: - Visual analog scale - Duration was measured in hours Pain intensity and duration were significantly reduced in the exercise groups compared to CG. There were no significant differences between intervention groups.
Samy et al. (2019).	N= 98 - 49 women performed Zumba (Z) - 49 women had no intervention (CG)	8 weeks - Z: 2 days/week 60' of Zumba including a warm up song and a cool down song.	Instruments for data collection: - Visual analog scale - Duration was measured in hours - Questionnaire on menstruation characteristics The intensity and duration of menstrual pain decreased significantly in Z compared to CG.
Shirvani et al. (2017).	N= 122 - 61 women exercised (E) - 61 women took ginger (G)	8 weeks - E: 3 days/week 5' of warm-up movements in standing position, followed by 6 stretching exercises for the abdomen and pelvis for 10'. - G: 250 mg/6h of ginger capsules until pain relief.	Instruments for data collection: - Visual analog scale - Questionnaire for demographic and menstrual characteristics E was significantly more effective than G for pain relief, dysmenorrhea intensity, and decreased menstrual duration in the second cycle.
Sutar et al. (2016).	N= 100 - 50 women undertook aerobic exercise (A) - 50 women did not perform physical exercise (CG)	8 weeks - A: 3 days/week. Aerobic dance with an intensity of 60-80% FCmax. with 10' warm-up and 10' cool down.	Instruments for data collection: - Visual analog scale - SF 36 for quality of life Pain in A decreased significantly from the beginning of the intervention and continued to decrease during the following 3 cycles. In addition, a significant difference in quality of life was also seen in A.
Vaziri et al. (2015).	N= 105 - 35 women did aerobic exercise (A) - 35 women performed stretching exercises (E) - 35 women had no intervention (CG)	8 weeks - A: 3 days/week on a 20' treadmill (4 stages of 5'). Stages 2 and 3 were those of maximum intensity. Same intensity for all participants. - E: 3 days/wk. 10 stretching exercises of abdomen, pelvis, and groin repeated 5 times. Started by holding 10" and each session added 1'.	Instruments for data collection: - Menstrual symptom questionnaire, rating intensity from 1 to 5. Significant difference between A and CG, as well as between E and CG in terms of dysmenorrhea intensity. However, no differences were shown between the intervention groups.
Yang and Kim (2016)	N= 40 - 20 women did yoga program (Y) - 20 women did not participate in the yoga program (CG)	12 weeks Y: 1 day/week 60' of yoga combining exercise, relaxation, and meditation.	Instruments for data collection: - Visual analog scale - Menstrual Distress Questionnaire Pain intensity and menstrual distress scores decreased significantly in Y compared to CG.
Yonglitthipagon et al. (2017).	N= 34 - 17 women practiced yoga (Y) - 17 women did not receive any form of exercise (CG).	12 weeks - Y: 2 days/week. 30' of yoga at home with clear instructions and poses.	Instruments for data collection: - Visual analog scale - SF 36 for quality of life Significant improvement in menstrual pain, fitness, and quality of life in Y more than in CG.

As can be seen, 100% of the articles shown in Table 1 pointed to physical exercise as a positive treatment for PD, improving some of its symptoms. 94.7% showed a reduction in menstrual pain and intensity, in 42.1% of the articles the duration of pain was reduced, and in 26.3% the menstrual distress scores improved. Important aspects such as improved quality of life and functionality were noted in 21.1% of the interventions. In addition, 10.5% of the women reduced the amount of analgesics consumed.

Discussion

Nowadays, non-medical approaches are also studied for the treatment of PD and its symptoms. One of them is exercise and physical activity (Motahari-Tabari et al., 2017). As can be seen in the previous section, among all the interventions performed, it is perceived how women who exercise show less severe dysmenorrhea and greater positive effects than sedentary women (Sutar et al., 2016).

Numerous experts claim that this improvement is due to the increase in blood flow and metabolism of the uterus during exercise, being effective in reducing symptoms of dysmenorrhea (Saleh et al., 2016). So, as stated by Gmoorthy et al. (2018), increasing metabolism is a key to the reduction of these symptoms. Shirvani et al. (2017) justify it with that this improvement in pelvic blood circulation, what it prevents is the aggregation of prostaglandins. In other words, as Dehnavi et al. (2018) point out, exercise can lead to a more rapid transfer of waste and prostaglandins from the uterus.

Another studied cause that helps in the reduction of PD symptoms is that exercises also stimulate the production of endorphins, which act as natural painkillers in the body (Aboushady and El-saidy, 2016). The same is the opinion of Sutar et al. (2016), who note that exercise increases the release of several neurotransmitters and hormones such as endorphins, estrogens, and dopamine. The feeling of euphoria and satisfaction after athletic exertion is accompanied by the release of endogenous opioids and the production and release of other hormones and catecholamines, an effect that could help reduce pain sensitivity and other symptoms experienced by women with PD (Ortiz et al., 2015).

Kannan et al. (2019) highlight endocannabinoids as another mechanism contributing to exercise-induced analgesia. Endocannabinoids are molecules that

contribute to the control of pain transmission within the brain and spinal cord where cannabinoid receptors are found. What is interesting that these authors expound is that elevations in endocannabinoid concentrations have been observed in peripheral blood following aerobic exercise (Kannan et al., 2019). Similarly, they also comment that exercise induces the production of regulatory macrophages in physically active muscles. These macrophages are known for their ability to secrete anti-inflammatory cytokines and counteract the effect of other macrophages that secrete proinflammatory cytokines. Accordingly, Kannan et al. (2019) gather that after physical activity, the overall effect is an increase in anti-inflammatory cytokines that are responsible for pain reduction.

For Heidarimoghadam et al. (2019), the role of adipose tissue is very important in controlling the balance of sex hormones. This tissue stores a variety of lipids that can metabolize steroids, including androgens, and increase prostaglandin production. In fact, Heidarimoghadam et al. (2019), point to Body Mass Index (BMI) as a factor to watch in PD. This can be regulated by physical activity, as recalled by Ortiz et al. (2015), this being a tool that mobilizes accumulated energy and, therefore, fundamental to achieve energy balance and adequately control the person's weight. On the other hand, Sutar et al. (2016) point out the effect of blood leptin in women with PD. Leptin is a hormone secreted by fat cells and regulates the metabolism of the hypothalamic-pituitary-gonadal axis, as well as having an important role in human reproduction. This hormone exerts its metabolic and neuroendocrine effects through its receptors in the emotional control area of the hypothalamus. Sutar et al. (2016) corroborate that physical activity reduces the amount of leptin in the blood to 30-34% as a consequence of the reduction in the amount of adipose tissue, the main producing tissue of this hormone.

Sutar et al. (2016), also add another interesting element to the relationship between PD and exercise: the involvement of stress. As Shirvani et al. (2017) specify, stress increases uterine contractions, with an effect on the nervous system. Furthermore, Vaziri et al. (2015) argue that stress increases sympathetic activity; therefore, as physical exercise reduces and moderates stress, sympathetic activity also decreases in the short-medium term. Likewise, it increases parasympathetic activity during rest, thus reducing menstrual symptoms (Dehnavi et al., 2018). Also, Ortiz et al. (2015) subscribe that there is a relationship between physical activity and decreased anxiety and depression, increased self-esteem, academic performance, decreased use of some substances of abuse, and appreciation of a more fulfilling life. Thus, exercise can decrease ruminations and

promote positive thoughts, thereby decreasing short-term depression, increase concentration, and improve mood and behavior (Sutar et al., 2016).

Moving on to discuss the different interventions performed by the authors, the most commonly used training method is stretching exercises. According to the observed studies, all these interventions have a positive effect on PD (Aboushady and El-saidy, 2016; Fallah and Mirfeizi, 2018; Gmoorthy et al., 2018; Kanwal et al., 2016; Kiranmayi et al., 2016; Motahari-Tabari et al., 2017; Saleh et al., 2016; Shirvani et al., 2017 and Vaziri et al., 2015). As Saleh et al. (2016) write in their article, contracted ligamentous bands in the abdominal region are the causative factor of physical compression of the nerve pathways and their irritation. Consequently, as they point out in some reviewed studies, stretching exercises have a positive effect by decreasing abdominal spasms and pressure on the nerves (Motahari-Tabari et al., 2017 and Shirvani et al., 2017). Likewise, it can be observed how stretching generates greater benefits than ginger (Shirvani et al., 2017), mefenamic acid (Motahari-Tabari et al., 2017), or massages (Fallah and Mirfeizi, 2018).

In contrast, comparing stretching exercises with aerobic exercises, it can be perceived how the benefits of the latter are greater (Gmoorthy et al., 2018 and Kiranmayi et al., 2016). Large improvements in PD with this method are found in the articles studied (Dehnavi et al., 2018; Kannan et al., 2019; Kiranmayi et al., 2016; Sutar et al., 2016 and Vaziri et al., 2015), including modalities such as dance (Gmoorthy et al., 2018) and Zumba (Samy et al., 2019). These benefits are quite related to those discussed above on the general effects generated by physical exercise on PD. Sutar et al. (2016) suggest that aerobic exercises involving pelvic tilt, such as walking, cycling, or swimming, can improve blood flow, relax abdominal muscles, reduce pelvic pain, and relieve pressure on nerve centers, pelvic organs, and the digestive tract. In addition, among the numerous benefits of regular aerobic exercise are increased cardiovascular capacity, increased bone density, and reduced stress, thereby decreasing depression and improving mood, behavior, and concentration (Gmoorthy et al., 2018 and Sutar et al., 2016). Likewise, Kannan et al. (2019) add that moderate to vigorous intensity aerobic exercise improves sleep. It is also important to note that most aerobic exercise protocols feature a cool-down return, which gets the body to eliminate muscle acidosis and allows for faster venous return, which in turn helps prevent muscle cramps and sudden drop in blood pressure (Sutar et al., 2016).

Another article by Ortiz et al. (2015) focuses on the study of Kegel exercises as a method for PD improvement. In the early 1940s, gynecologist Kegel creates this series of exercises of the perineal musculature. Kegel exercises are beneficial for PD for the same reason as all other exercises, they increase local blood supply, which promotes faster elimination of prostaglandins (Ortiz et al., 2015). Similar effects were found by Saleh et al. (2016) in their study, in which core strengthening allowed the small intrinsic musculature surrounding the lumbar spine to be conditioned for greater performance, increasing blood flow and metabolism of the uterus, being effective in reducing PD symptoms.

Azima et al. (2015) used massages and isometric exercises as a study method. These exercises did not have as much benefit as the group that performed massages, but both succeeded in decreasing PD symptoms. According to Azima et al. (2015), the effect that isometric exercises have is to increase blood pressure by stimulating baroreceptors, decreasing pain, and stimulating the brainstem, which has centers for pain regulation and blood pressure control.

Yoga is a modality that is on the rise, and three of the included articles use this method to reduce menstrual pain (Kirthika et al., 2018; Yang and Kim, 2016 and Yonglitthipagon et al., 2017). One of the reasons why yoga is a good intervention method according to Yonglitthipagon et al. (2017) is because it can activate the pain modulatory system in the brain that projects to the spinal cord and promotes the secretion of beta-endorphin, which is a natural analgesic in the body. Simultaneously, it improves the quality of life (functional capacity, vitality, mental health, social aspects, bodily pain, and general health domains) by linking body movement with breathing, activating the "relaxation response" in the neuroendocrine system and parasympathetic nervous system, resulting in improved metabolism, with breathing, heart rate, blood pressure, and adequate muscle tension (Yonglitthipagon et al., 2017).

Yang and Kim (2016) performed a type of yoga called Namaskara and Nidra, with which they also had great improvements in PD symptoms. They give as an answer that Namaskara induces pain relief and nervous/endocrine balance. On the other hand, the deep relaxation techniques of yoga Nidra lead to a relaxation response, thus reducing sympathetic nervous system activity and oxygen consumption, decreasing oxidative stress and increasing pain relief (Yang and Kim, 2016).

Lastly, in the study by Kirthika et al. (2018), they evaluated yoga asana, with which several benefits were also found. This type of yoga is divided into Ustrasana, Janusirsasana, and Dhanurasana. The first of these helps to relieve menstrual cramps by stretching the anterior aspect of the trunk and also by strengthening the back region, it improves spinal flexibility and also improves posture (Kirthika et al., 2018). Janusirsasana stimulates the reproductive organs and thus menstrual cramps are reduced, stretches the hip abductor and hamstring muscles and also relieves headaches, anxiety, and fatigue and also improves insomnia. In addition, the women in the Kirthika et al. (2018) study also performed Dhanurasana, a modality that increases blood flow to the uterus and keeps the body relaxed.

This study compared yoga asana with fitball exercises, which had a slight improvement over yoga alone on the distress questionnaire (Kirthika et al., 2018). The improvements in symptoms are due to the fact that the proposed fitball exercises, like yoga, improve blood supply and nutrients to the lower abdomen and lower back region, helping to relieve menstrual cramps (Kirthika et al., 2018).

Finally, the study by Heidarimoghadam et al. (2019) is based on the FITT principle, whose initials correspond to the frequency, intensity, time, and type of exercise. This has great advantages, as it helps to create a more effective plan to achieve the proposed objectives, controlling and performing a correct progression of the exercises; aspects that must be taken into account in any other training program (Heidarimoghadam et al., 2019).

This review has some limitations, which are described below: there is a lack of studies with a specific method studied that is effective for PD, since there is controversy in some results due to the difference in protocols. This makes it difficult to compare them and, consequently, to recognize which ones generate the greatest benefits. Along these lines, the time period of the interventions is different and generally short, with very few (n= 6) interventions being longer than 8 weeks, making many adaptations by exercise barely able to be reflected in the results. Similarly, the sample size is too small. On the other hand, as many of the selected studies point out, there are some data such as the diet of the participants, the hours of sleep, age or the number of analgesics taken, which have not been monitored in the studies and which may have repercussions when extracting the results.

Conclusions

This review allows us to affirm that regular physical exercise is a safe and effective method to reduce the symptoms produced by PD. Prolonged practice over time will also have long-term beneficial effects, further reducing these symptoms and improving the overall health of the individual. Aerobic exercise appears to be the most effective training method for symptoms of dysmenorrhoea, followed by some stretching exercises or yoga. In addition, another important part of this treatment for PD is that it does not generate side effects in the body. Future research with real and continuous interventions, with larger sample sizes and longer follow-up periods are recommended. It would be of great interest to record the comments of the people who have intervened in the studies in order to know their impressions and have feedback. Similarly, it is considered essential to record the type and quantity of analgesics consumed before, during, and at the end of the intervention. Likewise, a future line of research in this work could be based on studying the effects of pain on other aspects of life, such as psychological and emotional effects.

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