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The Effectiveness of Physiotherapy Interventions in Minimizing Pain for Dysmenorrhea: A Meta-Analysis of Clinical Outcomes

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Abstract

Background: Dysmenorrhea or menstrual pain is a common complaint in women when they are on period time. The main symptom of dysmenorrhea is pain in the lower abdomen. However, this lower abdominal pain has an impact on the occurrence of other disorders, such as fatigue, lack of enthusiasm to do daily activities, and other disorders, such as activities at school. A further impact of this pain is a decrease in quality of life. Physiotherapy interventions, including exercises, manual therapy, and electrotherapy, offer non-pharmacological treatment options. This study evaluates the effectiveness of physiotherapy interventions in reducing menstrual pain. **Method**: A systematic review and meta-analysis were conducted on studies published between 2015 and 2024. Databases included Google Scholar, ScienceDirect, and PEDro database. The keyword to search for the article was PICO. Population (P): Patients with primary dysmenorrhea. Intervention (I): Physiotherapy intervention, Comparison (C): Control subjects who either received no treatment, standard pharmaceuticals (e.g., NSAIDs, hormonal therapy), or other non-physiotherapy interventions, and Outcome (O): Decrease in pain intensity in the menstrual pain. **Result:** The analysis used random-effects models to estimate the effectiveness of interventions based on the Visual Analog Scale (VAS) for pain. Out of 4607 studies, 11 met the criteria for meta-analysis. Physiotherapy interventions significantly reduced pain compared to controls (SMD = -1.32, 95% CI [-1.88; -0.77], $P < 0.01$) with moderate heterogeneity ($I^2 = 45\%$). Comparisons between specific physiotherapy methods showed no significant differences (SMD = -0.09, 95% CI [-1.49; 1.32], P = 0.88), with high variability ($I^2 = 89\%$). **Conclusion:** Physiotherapy intervention is effective in reducing menstrual pain, but outcomes vary across methods. Further research should address factors affecting variability to optimize treatment strategies.

Keywords: Dysmenorrhea, physiotherapy, meta-analysis.

Introduction

Dysmenorrhea, i.e., painful menstruation, is a common manifestation that afflicts a high proportion of women globally, especially during the reproductive years. It is typically classified into primary and secondary types. Primary dysmenorrhea is pain associated with menstruation and with no visible etiological pathological factor known to involve both uterine contraction and high levels of prostaglandins. In particular, secondary dysmenorrhea is associated with specific gynecological pathologies such as endometriosis or fibroid, etc.

Although primary dysmenorrhea is very frequent in women in their twenties and tends to get better with age or

with the completion of pregnancy (López-Liria et al., 2021), secondary dysmenorrhea is always accompanied by its own increase in intensity with time. Dysmenorrhea causes a profound consequence on the everyday life of women, and this, in turn, leads to absenteeism either to school or job, loss of efficiency, and a decrease in quality of life. Thus, effective intervention strategies are also of urgent importance to alleviate the physical load and psychological distress caused by it. Although dysmenorrhea has a problematic impact on sufferers, not all women feel the need to seek treatment for this condition. A lack of knowledge about dysmenorrhea influences the search for treatment. According to Za'idah & Harlianti (2024), the higher a person's level of knowledge, the better the attitude of seeking self-treatment or self-medication for dysmenorrhea (Harlianti et al., 2024)

Dysmenorrhea is caused by ischemia in the muscles of the uterus, where excessive contractions occur due to excessive prostaglandin production. Prostaglandins have two effects on the uterus muscles; the first is vasoconstriction of the arteries, which has an ischemic impact resulting in muscle spasms and cramps in the superficial layer of the endometrium. The second effect of prostaglandins is increased myometrium contractions (Dawood, 2006; Iacovides et al., 2015)

There are several approaches to reducing the symptoms and impact of dysmenorrhea, namely with, pharmacological and non-pharmacological approaches. The approach using acupuncture, local application of heat or massage, warm compress, kinesio tapping, herbal therapy, and transcutaneous nerve stimulation is non-pharmacological. Other forms of this approach are exercises such as core muscle strengthening, aerobic exercises including chair exercises, stretching exercises such as forward bend stretches, lunges of both legs, squats, forward stand cross stretches, dorso-lumbal fascia stretches, chest stretches, adductor stretches, prone knee flexion has shown different results in pain relief and premenstrual syndrome. Exercise is proven to be a preventive measure and treatment. Nutritional treatments such as vitamins and minerals such as dark chocolate, B1, B6, E, and magnesium are also prescribed to reduce dysmenorrhea. Pharmacological interventions, e.g., nonsteroidal anti-inflammatory drugs (NSAIDs) and hormonal contraceptives, have been the first-line treatment modalities in dysmenorrhea. Notwithstanding the reality that these approaches are effective in alleviating pain in a large proportion of women, they are not free of some caveats (S Saleh & E Mowafy, 2016; Sinurat & Novita, 2022; Wahtini et al., 2021) (Arianeputri & Wahyuni, 2024). For example, NSAIDs can cause gastrointestinal discomfort, while even a transient course of hormonal replacement therapy has been reported to produce side effects, i.e., weight, behavioral, and menstrual changes (Aboualsoltani et al., 2020). These drawbacks have elicited even greater interest in non-pharmacological interventions, i.e., physiotherapy-based interventions, as an intervention for dysmenorrhea. Physiotherapy is a nonsurgical adjunctive therapy to menstrual pain by the correction of musculoskeletal and pelvic floor dysfunctions, which may be the cause of the pain itself. The latest research has demonstrated multiple physiotherapeutic treatments such as pelvic floor muscle exercise, manual therapy, electrotherapy, and relaxation exercise may offer notable symptomatic relief from menstrual pain symptoms and consequently enhance the overall quality of life (Sharma et al., 2023; Tremback-Ball et al., 2023). However, the clinical effect of these interventions is still disparate, so a systematic review and meta-analysis of intervention effectiveness is performed.

Physiotherapy intervention in dysmenorrhea rehabilitation is grounded in the growing body of evidence of the association between pelvic floor muscle dysfunction and menstrual pain. The pelvic floor muscle plays an essential functional role in supporting the pelvic organs, including the vagina, bladder, and rectum. The disordered function of these muscles can all factor in menstrual pain by causing a mechanical imbalance, impeding blood flow, and sensitizing the tissue to painful sensations (Desai, 2022). Physiotherapies (e.g., pelvic muscle training and manual therapies) are recommended to address underlying dysfunctions. For example, pelvic floor exercises increase the muscle tone of the involved muscles, improve blood circulation, and improve

surrounding muscles' relaxation around the time of menses, which in turn has the potential to decrease the intensity of the uterine contractions and pain (Zheng et al., 2024). Manual therapy (e.g., myofascial release and sacral mobilization) is frequently used for the treatment of pelvic and lower back pain, which are believed to originate from menstruation (Sharma et al., 2023). Physiotherapy treatments, in addition to musculoskeletal treatment, include strategies for relaxation, including deep breathing exercises and mindfulness, to address the stress response that translates into pain during menstruation (Wahyuni & Maghfiroh, 2022).

Transcutaneous electrical nerve stimulation (TENS) electrotherapy is another widely applied physiotherapy modality for dysmenorrhea treatment. TENS is the electrical transcutaneous stimulation of low voltage electrical current to the skin, which is believed to block pain stimuli and induce the release of endogenous pain-relieving factors (endorphins). Research has demonstrated TENS has a remarkable effect in significantly reducing the power of menstrual pain, supplying relief for a substantial number of women with primary dysmenorrhea (Tremback-Ball et al., 2023; González-Mena et al., 2024). Although promising results have been obtained by using these interventions, until now, the scientific community has not been able to establish a consensus on their general effectiveness. The effects of physiotherapy on dysmenorrhea have been tried to be identified by some (systematic review and meta-analysis) studies. However, the findings have not been consistent. Levels of analgesic relief and quality of life improvements have been reported in the trials involving physiotherapy and some other studies (i.e., less favorable results) (Sharma et al., 2023).

A systematic review by López-Liria et al. (2021) studied the effectiveness of different physiotherapy treatments in treating primary dysmenorrhea (López-Liria et al., 2021). This review also found that interventions, e.g., pelvic floor muscle exercise, TENS, and manual therapy, may be relevant to reducing pain and ameliorating menstrual function. Similarly, a meta-analysis by González-Mena et al. (2024) reported that manual therapy plus electrotherapy modalities provided significant pain relief in women with primary dysmenorrhea. However, the authors also claimed that those studies exhibited significant variation in intervention protocol, sample size, and outcome measures, resulting in widely varying conclusions. This also supports the need for well-designed, large-scale studies to determine the optimal physiotherapy interventions for dysmenorrhea. Furthermore, the variance of outcomes described in the studies emphasizes the need for tailored treatment strategies since the response to various physiotherapy modalities may differ in women suffering from dysmenorrhea.

Besides manual therapy and electrotherapy, exercise therapy also gains much attention as a future treatment of primary dysmenorrhea. Multiple studies have indicated that physical activity, particularly aerobic exercise and core exercises, can attenuate menstrual pain severity and duration. For instance, a study by Zainab et al. (2021) found that core-strengthening exercises are effective as an intervention to ameliorate menstrual pain in women with primary dysmenorrhea (Zainab et al., 2021). Additionally, a meta-analysis and systematic review by (Sharma et al., 2023)further hypothesized that exercise therapy could be a useful adjunctive treatment in addition to standard pharmacologic agents for dysmenorrhea treatment, continuing benefits when symptomatic relief is not possible or desired. Exercise has been suggested to exert its analgesic effect via enhanced blood flow, endorphin release, and attenuated levels of skeletal muscle tone, which may contribute to menstrual pain analgesia. There is no data regarding how exercise alters dysmenorrhea mechanistically, and studies need to be conducted to determine the ideal type and intensity of exercise.

Another kind of non-pharmacological treatment with promise is the application of deep breathing exercises and their associated relaxation techniques. These methods have been created to alleviate stress and induce a sense of relaxation that has analgesic properties. In contrast, deep breathing exercises activating the parasympathetic nervous system provide the feeling of calmness and attenuation of muscular contractions that may overcome menstrual pain (Wahyuni & Maghfiroh, 2022). A study by Sharma et al. (2023) also mentioned the efficacy of

relaxation methods for menstrual pain, especially when combined with other physiotherapy methods (Sharma et al., 2023). This would seem to point towards the value of an integrated multimodality strategy, one in which a range of physiotherapy modalities are used to manage primary dysmenorrhea.

Although physiotherapy treatments have potential for the treatment of primary dysmenorrhea, the evidence base is unconvincing. Multiple systematic reviews and meta-analyses have drawn attention to the paucity of high-quality, well-designed studies to date that will inform on the efficacy of these interventions (Aboualsoltani et al., 2020; Tremback-Ball et al., 2023). Factors including sample size, methodological quality, and treatment protocol heterogeneity underlie the variation in study findings. Moreover, the pathophysiological basis of the efficacy of physiotherapy treatments for dysmenorrhea remains unclear, and it is necessary to conduct further studies to explain the physiological mechanism of physiotherapy around dysmenorrhea. Because dysmenorrhea is endemic and non-pharmacological management is a topic of growing interest, there is a need for further research on the potential benefits that physiotherapy treatments can offer in the management of dysmenorrhea. The current systematic review and meta-analysis aim to assess the evidence of the efficacy of physiotherapy interventions in primary dysmenorrhea. Based on the synthesis of a large array of research, this review aims to provide a clinical standpoint regarding the results of the treatments carried out with physiotherapy, with the final goal of providing information for clinical practices and directing future research in this area. The findings from this review may be able to provide valuable data for the selection of more targeted and personalized treatments for primary dysmenorrhea women, partly to improve their quality of life and decrease reliance on pharmacological treatments.

Methodology

The methodology of this study is based on a systematic review and meta-analysis of existing research sourced from databases such as ResearchGate, ScienceDirect, Google Scholar, and the Physiotherapy Evidence Database (PEDro) on physiotherapy interventions for managing primary dysmenorrhea. The primary aim is to evaluate the effectiveness of various physiotherapy treatments, such as pelvic floor exercises, manual therapy, electrotherapy, and exercise therapy, in alleviating menstrual pain and improving the quality of life in women suffering from primary dysmenorrhea. A systematic review approach was chosen due to its ability to comprehensively synthesize data from multiple studies, thus providing a more accurate and reliable estimate of the treatment effects. The research included in this analysis was sourced from peer-reviewed journals, databases, and reputable sources focusing on physiotherapy for managing dysmenorrhea. The articles included were published between 2015 and 2024; hence, the review will cover the most recent research in this area.

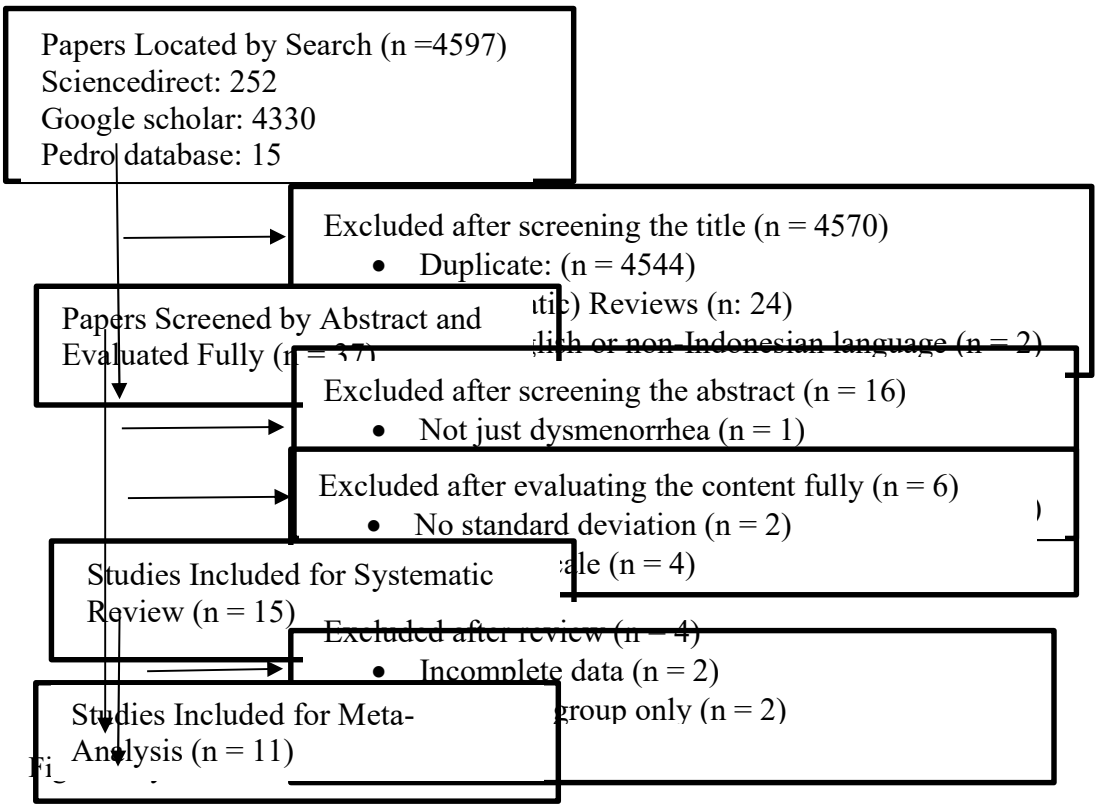
The methodology used in this research is a systematic review and meta-analysis of current literature concerning physiotherapy interventions for managing primary dysmenorrhea. The main goal of the study is to assess the efficacy of multiple physiotherapy treatments, including pelvic floor exercise, manual therapy, electrotherapy, and exercise treatment, in alleviating menstrual pain in women with primary dysmenorrhea. The research included in this analysis was sourced from peer-reviewed journals, databases, and reputable sources focusing on physiotherapy for managing dysmenorrhea. Contributing articles spanned from 2015 to 2024, respectively. The article is full-text in English, and the review will cover this topic's current state of the art.

The systematic review was carried out according to the PICO framework to maintain a defined methodology for the study question. The components of PICO are outlined as follows: Population (P): Patients with primary dysmenorrhea without other pathologic factors; Intervention (I): Physiotherapy intervention, which consists of pelvic-floor exercises, manual therapy, electrotherapy (e.g., transcutaneous electrical nerve stimulation), and exercise therapy (e.g., aerobic exercises or core-strengthening exercises); Comparison (C): Control subjects who either received no treatment, standard pharmaceuticals (e.g., NSAIDs, hormonal therapy), or other non-

physiotherapy interventions; Outcome (O): Decrease in pain intensity in the menstrual pain
Systematic data extraction was conducted based on a sequential study results review, including treatment protocols, treatment efficacy, and reported adverse events. For the meta-analysis, effect sizes were calculated to reflect the magnitude of treatment effect between studies. The analysis consisted of estimating weighted mean differences (WMDs) and standardized mean differences (SMDs) to compare the efficiency of alternate physiotherapy interventions. Statistical techniques (e.g., random-effects models) were used to assess variability in study designs and results. The quality of the included studies was evaluated with established instruments, e.g., the Cochrane risk of bias tool, which aids in assessing potential sources of bias and the validity of results. The outcomes of the meta-analysis were pooled and described in relation to the available literature, with suggestions and constraints made according to the strength of the evidence. In this approach, the results can be of clinical relevance to gain insight into the clinical effectiveness of physical therapy treatment for primary dysmenorrhea and to identify gaps in the current body of evidence from which future research can be advanced.

Result and Discussion

Based on the search, 4607 studies were discovered, and after the inclusion criteria were consulted, 15 studies were selected and sourced from databases such as ScienceDirect, Google Scholar, and the Physiotherapy Evidence Database (PEDro). Further investigation resulted in 11 studies to be included in the meta-analysis. The following is the structured approach to get to the selected studies.



Pain Intensity

This study includes two primary meta-analyses to evaluate the effectiveness of physiotherapy interventions in

managing primary dysmenorrhea based on the Visual Analog Scale (VAS) for pain assessment. The first analysis focuses on a meta-analysis of the comparison between groups to evaluate the differences in VAS scores after the intervention. This approach aims to identify how significantly pain levels change in groups receiving physiotherapy interventions compared to control groups or other groups undergoing different treatment methods. The second analysis addresses a meta-analysis comparing two approaches to evaluate the differences in VAS scores after the intervention. The goal is to determine which physiotherapy method is more effective in reducing pain intensity based on the results of various systematically compared studies. These two analyses provide an essential foundation for understanding the effectiveness of physiotherapy interventions in managing primary dysmenorrhea and offer guidance for evidence-based clinical practice.

Based on Figure 2, the meta-analysis combines five studies with 243 participants in the experimental group and 170 in the control group. The overall Standardized Mean Difference (SMD) is -1.32 with a 95% confidence interval of [-1.88; -0.77], indicating that the intervention in the experimental group is significantly more effective than in the control group. The test of the overall effect demonstrates $t_4 = -6.59$ with $P < 0.01$, thereby confirming the statistical importance of the presented results. Each study also reports statistically meaningful results, with confidence intervals not going through zero. The weights of the studies differ where the highest weight is Shahr-Jerdy et al, 2012 (31.3%).

The heterogeneity of studies is moderate, with $I^2 = 45\%$ and $P = 0.12$ ($Chi^2 = 7.22; df = 4$), highlighting no statistical significance of heterogeneity. The between-study variance (Tau²) is 0.0578, indicating rather low variability. On top of that, the prediction interval is [-2.25; -0.39], which means the predicted effect in future studies is likely still within a significantly negative range. These findings suggest that the intervention being studied has a significant, consistent, and reliable impact on the measured outcome, with an acceptable level of heterogeneity.

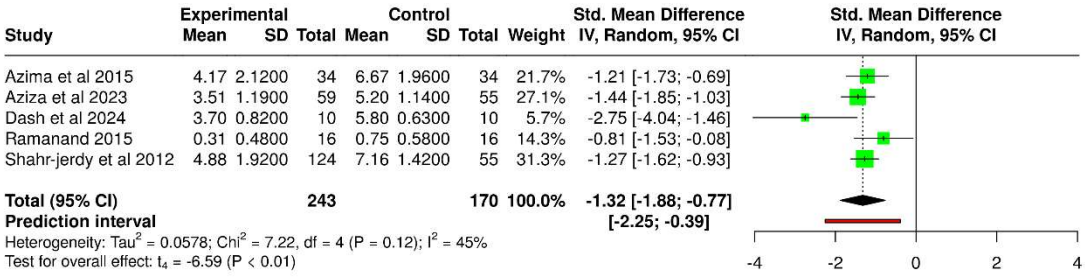


Figure 2 Forest plot of the comparison between the groups of the difference in the visual analog scale (VAS) after the intervention.

Figure 3 shows the result of a meta-analysis comparing two techniques (Method 1 and Method 2) in 6 studies. The overall Standardized Mean Difference (SMD) is -0.09 with a 95% confidence interval of [-1.49; 1.32], which means there is no statistically significant difference between the two techniques. The prediction interval [-2.84; 2.66] reflects significant variability and uncertainty in the findings of future work. Individual study findings vary, with Arshad et al. (2018), Ganesh et al. (2015), and (Paithankar & Hande, 2016) in favor of Method 2, while (S et al., 2018) strongly favor Method 1. Meanwhile, studies by Agrawal et al. (2019) and Guruprasad et al. (2019) show no significant differences between the methods.

The heterogeneity among the studies is very high ($I^2 = 89\%$), as confirmed by significant heterogeneity statistics ($Chi^2 = 45.66; P < 0.01$). This high level of heterogeneity indicates that the variability in the results is predominantly due to differences between studies rather than random chance. The between-study variance (Tau²) is 0.8255, reflecting this substantial variability. The overall test for effect ($t_5 = -0.16, P = 0.88$)

confirms no statistically significant difference between the two methods when pooled across all studies. This suggests that the effectiveness of Method 1 and Method 2 varies widely depending on specific contexts, limiting the generalizability of the findings.

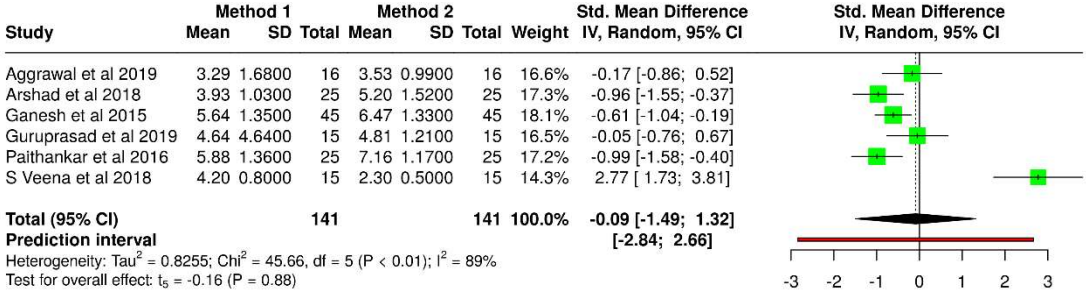


Figure 3 Forest plot compares the methods of the difference in the visual analog scale (VAS) after the intervention.

Discussion

According to Figure 2, the first meta-analysis showed that the treatment used in the experimental group was significantly more effective than the control group, i.e., the therapy provided a demonstrable advantage. These results are consistent with a study conducted by Abaraogu et al., (2017), exercise therapy is effective on pain and quality of life of patients with primary dysmenorrhea (Abaraogu et al., 2017). The overall results were statistically significant, and each study offered strong evidence to support the hypothetical effects of the intervention. Although moderate levels of heterogeneity have been observed in studies, the results show a consistent and robust impact of the intervention on the targeted outcomes. The prediction interval suggests that future work is likely to find similar results, thus providing further evidence for the effectiveness of the intervention in various settings. Other researchers also made identical findings that exercise therapy is effective in reducing pain and increasing the quality of life among young women with primary dysmenorrhea (Carroquino-Garcia et al., 2019; Desai, 2022; Jyoti Kapoor, Navpreet Kaur, 2017; Rigal et al., 2025; Wahyuni et al., 2022; Zheng et al., 2024)

The other researchers also found the effectiveness of physiotherapy treatment with other modalities. Physiotherapy improves pain intensity after performing different interventions (manual therapy, acupuncture, electrotherapy, acupressure, and exercises) in patients with primary dysmenorrhea (López-Méndez N, Girón-Damas C, 2020) Abaraogu et al., (2017) and Li et al., (2024) also found that manual therapy promise in effectively relieving menstrual pain with minimal adverse events in the short term, outperforming both no-treatment and NSAIDs. However, this conclusion is tempered by the low quality of the included RCTs, highlighting the necessity for more robust trials to validate it (Abaraogu et al., 2017; Li et al., 2024). In alleviating premenstrual symptoms and improving quality of life, physiotherapy interventions can be promising and effective, especially with Elastic therapeutic taping (ETT). ETT indicated short-term improvements in anxiety associated with primary dysmenorrhea (Verma et al., 2024). ETT showed moderate to high-quality evidence in improving pain, anxiety, and quality of life of women with primary dysmenorrhea. A scarcity of evidence on the long-term effects of therapeutic taping in primary dysmenorrhea is observed (Bandara et al., 2022)

In contrast, the second meta-analysis in Figure 3 shows no significant differences between the two proposed methods. The confidence interval passes through point 0, which means that individual study outcomes are dramatically disparate, and pooled estimates lack the power to favor one method over the other firmly. Due to the high heterogeneity level, the methods' power may be an issue of study design or the population rather than

denoting a fixed effect. This variability limits the extent to which the findings can be generalized, and it motivates the discussion of whether, in subsequent studies, the choice between the two strategies has a real impact.

Generally speaking, although the treatment in the first analysis seems to be consistently effective, the study of approaches in the second analysis brings to the forefront the difficulties in reaching definitive conclusions with the amount of variation present. The high heterogeneity observed in the second meta-analysis shows that different contexts can lead to different results, suggesting the need for further research to explore the factors that explain the variability in this effect. Both analyses' results highlight the importance of considering study design, population, and context in interpreting meta-analytic results.

Conclusion

The first meta-analysis reveals that experimental group intervention is systematically more potent than control group intervention, to consistent and reliable evidence across studies. Conversely, the second meta-analysis shows no significant difference between the two techniques, with great variability and heterogeneity that indicates that the performance of the two techniques may vary in specific contexts. These results emphasize the need to consider study design and context when interpreting meta-analysis results.

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