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Comparison of Warm Compress and Lavender Aromatherapy on Dysmenorrhea in Female Adolescents

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ABSTRACT

Introduction: *Dysmenorrhea is a common gynecological problem among female adolescents that affects academic performance, daily activities, and quality of life. Non-pharmacological interventions such as warm compresses and lavender aromatherapy are considered safe and practical alternatives for pain relief.*
Objectives: *This study aimed to compare the effectiveness of warm compresses and lavender aromatherapy in reducing menstrual pain among female adolescents.*
Methods: *A quasi-experimental study with a non-equivalent pretest–posttest control group design was conducted from January to March 2025 at SMK Puspa Bangsa, Banyuwangi. A total of 40 students with a history of dysmenorrhea were selected using proportionate stratified random sampling and divided into two groups: warm compress (n = 20) and lavender aromatherapy (n = 20). Pain intensity was evaluated at baseline and after intervention using a validated Numeric Rating Scale. The data were analyzed by paired t-tests for within-group contrasts and independent t-tests for between-group comparisons.*
Results: *The warm compress group showed a significant reduction in menstrual pain with a greater mean difference than the lavender aromatherapy group. While both interventions were effective, the warm compress group experienced a more pronounced decrease in pain intensity. Independent t-test results confirmed a significant difference in mean pain reduction between the two groups (p-value = 0.000; α<0.05).*
Conclusions: *Evidence from the study demonstrated that warm compresses reduced menstrual pain more effectively than lavender aromatherapy in adolescent girls. Consequently, warm compresses can be endorsed as a straightforward, safe, and inexpensive method, with lavender aromatherapy serving as a supplementary option for relaxation and psychological ease.*

Introduction

Primary dysmenorrhea is one of the most common reproductive health problems experienced by adolescent girls and can reduce quality of life, learning activities, and daily productivity (Itani et al., 2022). This condition has a high prevalence and therefore requires non-pharmacological interventions that are effective, safe, and easy to implement (Ilmiah et al., 2023). Several studies have shown that warm compresses can reduce pain intensity by increasing blood circulation and relaxing the pelvic muscles (Amaliah, 2025; Ginting & Widuri, 2023; Lisa et al., 2023; Widianti et al., 2021), while lavender aromatherapy works through the relaxation of the central nervous system and has been proven to provide a natural analgesic effect (Christiana & Jayanti, 2020; Natassia & Mulyaningrum, 2021; Tangkas et al., 2025). Although previous studies have demonstrated the effectiveness of each intervention, research directly comparing warm compresses and lavender aromatherapy in adolescent girls remains limited (Yunianingrum &

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Widyastuti, 2018). Therefore, this study aims to compare the effectiveness of warm compresses and lavender aromatherapy in reducing dysmenorrhea pain among adolescent girls.

In Indonesia, the prevalence of dysmenorrhea among adolescent girls is high, with one study reporting rates of 64.25%, of which 54.89% is primary dysmenorrhea and 9.36% is secondary dysmenorrhea (Amaliah, 2025). In East Java, the prevalence is even higher, reaching 71.3% among adolescent girls (Puspitasari & Prajayanti, 2024). Although research in Surabaya shows that many adolescents have some knowledge of non-pharmacological therapies, such as lavender aromatherapy, gaps remain in understanding their proper use and potential side effects (Christiana & Jayanti, 2020; Natassia & Mulyaningrum, 2021). These data highlight the public health importance of dysmenorrhea, as high prevalence combined with limited effective management can negatively affect daily activities and quality of life. While pharmacological treatments, such as nonsteroidal anti-inflammatory drugs (NSAIDs), are commonly used, prolonged use can cause gastrointestinal irritation, drug dependency, and reduced effectiveness over time (Ilmiah et al., 2023). Therefore, non-pharmacological interventions, including warm compresses and aromatherapy, have gained attention as safe, accessible, and complementary strategies for managing menstrual pain in adolescents (Ferri Ardiyansah et al., 2024; Lisa et al., 2023; Tangkas et al., 2025). Considering the high prevalence in East Java and the need for safe, effective interventions, this study aims to compare the effectiveness of warm compresses and lavender aromatherapy in reducing dysmenorrhea pain among adolescent girls in Surabaya. The results are expected to provide evidence for implementing practical interventions to improve adolescents' well-being and daily functioning.

Several interventions have been explored to manage dysmenorrhea, including both pharmacological and non-pharmacological approaches. Pharmacological treatments, such as nonsteroidal anti-inflammatory drugs (NSAIDs) and hormonal contraceptives, are widely used to relieve menstrual pain. However, their long-term use can cause gastrointestinal irritation, dependency, and decreased efficacy over time (Ilmiah et al., 2023). In contrast, non-pharmacological therapies offer safer and more accessible alternatives for adolescents. Among these, warm compress therapy and lavender aromatherapy have been studied extensively and are considered both effective and practical. Warm compress therapy improves blood circulation, relaxes uterine muscles, and reduces ischemia-induced pain during menstruation (Amaliah, 2025; Umami, 2022). Lavender aromatherapy provides a calming effect, reduces muscle tension, and alleviates pain through its sedative and antispasmodic properties (Christiana & Jayanti, 2020; Natassia & Mulyaningrum, 2021; Tangkas et al., 2025). Previous studies have demonstrated the individual effectiveness of these two methods in reducing dysmenorrhea intensity, highlighting their potential as viable non-pharmacological options for adolescent girls..

Dysmenorrhea typically develops in a chronological sequence beginning with the onset of menstruation, during which excessive prostaglandin production in the endometrium leads to intense uterine contractions and reduced blood flow, resulting in ischemia and pain (Itani et al., 2022; Puspitasari & Prajayanti, 2024). This pain can trigger secondary effects such as nausea, fatigue, mood changes, and impaired daily activities, which significantly affect adolescents' quality of life. Despite growing evidence, most studies have investigated warm compress and lavender aromatherapy as separate interventions. Currently, there is a lack of studies investigating the combined use of these therapies, which might produce a synergistic benefit in reducing menstrual discomfort. Addressing this gap is important, as combined interventions are potentially more effective, low-cost, and feasible to implement in clinical and community settings. Therefore, this study aims to compare the effectiveness of warm compresses and lavender aromatherapy in reducing dysmenorrhea among female adolescents.

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Methods

This study employed a quasi-experimental design with a non-equivalent pretest–posttest control group approach to compare the effects of warm compress and lavender aromatherapy on dysmenorrhea among female adolescents. The research was conducted from January to March 2025 at SMK Puspa Bangsa, Banyuwangi. The target population consisted of 310 female students in grades X and XI, among whom 112 reported a history of dysmenorrhea. A probability sampling technique with proportionate stratified random sampling was applied to ensure proportional representation across strata.

Inclusion criteria were female students aged 15–18 who experienced primary dysmenorrhea, had regular menstrual cycles, were willing to participate in the study, and could follow the intervention procedures. Exclusion criteria included students with secondary dysmenorrhea caused by gynaecological disorders (e.g., endometriosis or pelvic inflammatory disease), those currently taking hormonal contraceptives or analgesics, participants with known allergies to lavender essential oil, and students with chronic illnesses that could interfere with pain perception or participation.

A total of 40 students who met the inclusion criteria were selected and randomly assigned into two groups of 20 participants each. The intervention procedures were administered as follows: the first group received a warm compress applied to the lower abdomen using a standard hot water bag at a safe temperature range of 38–40°C for 15–20 minutes during peak menstrual pain, while the second group was treated with lavender aromatherapy. For the aromatherapy intervention, lavender essential oil (Lavandula angustifolia) was administered by placing three to four drops on cotton, which participants inhaled for approximately 15 minutes. Both interventions were performed during the first two days of menstruation, when pain intensity was typically highest.

Pain intensity was measured before and after each intervention using a validated and reliable pain intensity questionnaire adapted from the Numeric Rating Scale (NRS), ranging from 0 (no pain) to 10 (worst pain imaginable). The instrument had been previously tested for validity and reliability and deemed appropriate for adolescent use. Data were analyzed using paired t-tests to evaluate within-group differences in pain intensity before and after the interventions, and independent t-tests to compare mean differences between the two groups. All statistical analyses were conducted at a 95% confidence level, and p-values less than 0.05 were considered statistically significant.

Results

Table 1. Characteristics of Respondents Based on Age, Age at Menarche, and Menstrual Cycle

Characteristics	Warm Compress		Lavender Aromatherapy	
	n	%	n	%
Age				
15 years	4	20	5	25
16 years	12	60	8	40
17 years	4	20	7	35
Age at Menarche				
12 years	5	25	3	15
13 years	7	35	6	30

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Characteristics	Warm Compress		Lavender Aromatherapy	
	n	%	n	%
14 years	5	25	10	50
15 years	3	15	1	5
Menstrual Cycle				
< 28 days	2	10	0	0
28–35 days	16	80	20	100
> 35 days	2	10	0	0
Menstrual Pain Scale				
1–3 (mild)	11	55	7	35
4–6 (moderate)	7	35	7	35
7–10 (severe)	2	10	6	30

Table 1 showed that most respondents in both groups were 16 years old, with 60% in the warm compress group and 40% in the lavender aromatherapy group. Most respondents in the warm compress group experienced menarche at 13 years (35%), whereas in the lavender aromatherapy group, most reported menarche at 14 years (50%). Regarding the menstrual cycle, almost all respondents had a normal cycle of 28–35 days, accounting for 80% in the warm compress group and 100% in the lavender group. Regarding the menstrual pain scale, more than half of the warm compress group reported mild pain (55%). In comparison, in the lavender aromatherapy group, the largest proportions were found in the mild and moderate categories (35% each), with 30% experiencing severe pain, higher than the warm compress group (10%).

Table 2. Differences in Mean Dysmenorrhea Scores (Warm Compress Group)

Warm Compress	Mean	Median	SD	Min–Max	95% CI	p-value
Pre	6.63	7.0	1.54	4.0-9.0	5.85-7.41	0.000
Post	3.70	4.0	1.49	1.0-6.0	2.98-4.42	

According to Table 2, the average menstrual pain score in the warm compress group was 6.63 (SD = 1.54, 95% CI: 5.85–7.41) before treatment, which declined to 3.70 (SD = 1.49, 95% CI: 2.98–4.42) following the intervention. Statistical testing confirmed a significant reduction in mean pain scores among adolescents after receiving the warm compress therapy ($p = 0.000$; $\alpha < 0.05$).

Table 3. Differences in Mean Dysmenorrhea Scores (Lavender Aromatherapy Group)

Lavender Aromatherapy	Mean	Median	SD	Min–Max	95% CI	p-value
Pre	5.33	5.0	1.29	3.0-8.0	4.68–5.98	0.000
Post	5.00	5.0	1.34	3.0-8.0	4.33–5.67	

As shown in Table 3, the lavender aromatherapy group had a pre-intervention mean pain score of 5.33 (SD = 1.29, 95% CI: 4.68–5.98), which decreased slightly to 5.00 post-intervention (SD = 1.34, 95% CI: 4.33–5.67). Statistical analysis confirmed a significant reduction in average menstrual pain scores following the lavender therapy ($p < 0.001$; $\alpha < 0.05$).

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Table 4. Comparison of Mean Differences in Dysmenorrhea Scores between Warm Compress and Lavender Aromatherapy Groups

Group	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Difference (Δ) ± SD	95% CI for Δ	p-value
Warm Compress	6.63 ± 1.54	3.70 ± 1.49	2.93 ± 0.85	2.31 – 3.55	0.000
Lavender Aromatherapy	5.33 ± 1.29	5.00 ± 1.34	0.33 ± 0.67	–0.21 – 0.87	0.000
Independent t-test			Δ = 2.60	1.98 – 3.22	0.000

Table 4 demonstrated that the reduction in dysmenorrhea scores was markedly different between the two interventions. The average reduction in pain scores was 2.93 ± 0.85 in the warm compress group compared to only 0.33 ± 0.67 in the lavender aromatherapy group. Independent t-test analysis indicated this difference was statistically significant, with a mean difference between groups of 2.60 (95% CI: 1.98–3.22; $p < 0.001$). These findings indicate that warm compress therapy significantly reduced menstrual pain compared to lavender aromatherapy.

Discussion

Differences in Mean Dysmenorrhea Scores of Warm Compress Group

The present study found that applying warm compresses significantly reduced menstrual pain among female adolescents, with the mean dysmenorrhea score decreasing from 6.63 to 3.70 (mean difference 2.93, $p < 0.05$). These results reinforce the role of non-pharmacological approaches in reducing primary dysmenorrhea, especially in adolescents who are highly affected by menstrual pain in their daily routines and school participation. The notable decline in pain intensity indicates that warm compress therapy may serve as a feasible option within school-based and community health initiatives.

Theoretically, the mechanism of warm compress is associated with vasodilation, which increases blood circulation, improves oxygen supply to the uterine muscles, and reduces ischemia that triggers pain during menstruation (Itani et al., 2022). The thermal stimulation also activates sensory nerve endings that close the pain gate at the spinal level, thereby reducing pain perception. This result is consistent with several studies: Lisa et al (2023), Ferri Ardiyansah et al (2024), and Wafiroh & Wulandari (2022) all demonstrated significant reductions in dysmenorrhea scores after warm compress application. Similarly, Septiana et al (2022) confirmed that warm compresses reduce adolescent menstrual pain. In contrast, Hartati et al (2023) suggested that combining warm water compresses with herbal therapy (ginger decoction) provided a more substantial effect than compresses alone, indicating that multimodal approaches might enhance outcomes.

From the researchers' perspective, the findings of this study underscore the potential of warm compresses as a safe, low-cost, and feasible non-pharmacological intervention that can be incorporated into adolescent reproductive health programs. However, this therapy's effectiveness may be influenced by factors such as temperature, duration of application, and individual pain sensitivity, as noted in previous studies (Syafika et al., 2022). This study has certain limitations, including a relatively small sample size and its focus on a single school setting, which may limit the generalizability of the results. Despite these limitations, the evidence consistently supports the use of warm compress therapy as a first-line management strategy for dysmenorrhea before resorting to pharmacological interventions. To further enhance pain relief, future research is recommended to investigate the combined application of warm compresses

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with complementary therapies, such as aromatherapy or herbal interventions, which may provide synergistic effects in reducing menstrual pain (Hartati et al., 2023)..

Differences in Mean Dysmenorrhea Scores of Lavender Aromatherapy Group

This study showed that lavender aromatherapy slightly decreased menstrual pain, with the mean dysmenorrhea score dropping from 5.33 to 5.00 (mean difference 0.33, p-value < 0.05). Although statistically significant, the reduction was smaller than that of the warm compress intervention. This indicates that while lavender aromatherapy has some effect on alleviating menstrual pain, its impact was limited when used as a single intervention for adolescent dysmenorrhea.

Theoretically, lavender essential oil contains linalool and linalyl acetate, which have sedative and analgesic properties by modulating the limbic system, enhancing relaxation, and lowering pain perception (Itani et al., 2022). Previous studies have shown positive outcomes, where lavender aromatherapy significantly reduced dysmenorrhea severity(Natassia & Mulyaningrum, 2021; Nisa, 2023; Tangkas et al., 2025). Similarly, Ristiani et al (2021) and Komalasari (2024) reported that lavender aromatherapy helped regulate emotional responses to pain and improved comfort. However, the more negligible effect in this study contrasts with Christiana & Jayanti (2020), who found more substantial pain reduction with lavender aromatherapy. This discrepancy may be influenced by variations in the dosage, duration of inhalation, or individual differences in olfactory sensitivity among adolescents (Septiana et al., 2022).

The researchers' findings suggest that while lavender aromatherapy can contribute to pain relief, it may be more effective as a complementary rather than a standalone intervention. The minor decline recorded in this research points to the potential advantage of using combined non-pharmacological therapies, including aromatherapy alongside warm compress, to improve treatment benefits. Given its accessibility, safety, and calming psychological effects, lavender aromatherapy still holds value for adolescent reproductive health programs. Future research should examine optimal administration techniques, duration, and potential synergistic effects when combined with other interventions to enhance efficacy.

Comparison of Mean Differences in Dysmenorrhea Scores between Warm Compress and Lavender Aromatherapy Groups

The results demonstrated that warm compress therapy led to a significantly larger decrease in dysmenorrhea than lavender aromatherapy. The average reduction was 2.93 in the warm compress group compared to just 0.33 in the lavender group, with an independent t-test confirming the statistical significance of this difference ($\Delta = 2.60$; $p < 0.001$). These findings indicate that although both treatments alleviated pain, the effect was substantially greater among those receiving warm compresses.

Theoretically, warm compresses relieve dysmenorrhea by increasing blood flow, relaxing abdominal muscles, and reducing uterine contractions, which helps lower prostaglandin activity, a major contributor to menstrual pain (Itani et al., 2022; Syafika et al., 2022). Prior studies have repeatedly demonstrated that warm compress therapy is effective in alleviating menstrual pain, including studies by Ferri Ardiyansah et al. (2024), Lisa et al. (2023), and Susilawati et al. (2024). On the other hand, lavender aromatherapy works primarily through the central nervous system, promoting relaxation and modulating pain perception (Natassia & Mulyaningrum, 2021; Tangkas et al., 2025). While both methods showed statistically significant changes, the physiological

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mechanism of heat application appears to provide more substantial direct pain relief than aromatherapy's indirect effects.

The researchers suggest that warm compresses ought to be regarded as the foremost non-pharmacological approach for managing dysmenorrhea in adolescents. At the same time, lavender aromatherapy may be a supportive or complementary option. The more substantial effect of warm compresses underscores their practicality, accessibility, and physiological basis for pain management. However, considering the psychological benefits of lavender aromatherapy, integrating both interventions may enhance overall comfort and adherence among adolescents. Future studies are recommended to explore the combined effect of heat therapy and aromatherapy, which may provide synergistic benefits in reducing menstrual pain more effectively.

Conclusion

The results of this study showed that both warm compresses and lavender aromatherapy alleviated dysmenorrhea among adolescent girls, with a more pronounced reduction in pain scores in the warm compress group. These outcomes suggest that warm compresses represent a safe, inexpensive, and practical non-pharmacological intervention, whereas lavender aromatherapy may serve as a complementary method by enhancing relaxation and psychological ease.

Ethics approval and consent to participate

The study received ethical clearance in accordance with institutional and national research standards. Prior to enrollment, participants were briefed on the objectives, procedures, and their rights, after which written informed consent was secured. Confidentiality and anonymity of participants were safeguarded throughout the study.

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