

A systematic review of the effects of lavender oil on primary dysmenorrhea

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Abstract: The purpose of this systematic review was to investigate lavender oil interventions for women experiencing primary dysmenorrhea and to determine the effectiveness of these interventions on dysmenorrhea. Six national and international databases were reviewed to retrieve and collect literature published up to August 8, 2024, describing randomized controlled trials of lavender oil interventions for women's dysmenorrhea. Two researchers independently screened the literature through abstracts and full-text articles. As a result of the literature search, a total of 174 articles were searched, and 158 of them were reviewed, excluding 16 duplicate articles. Of these, 31 articles were reviewed, excluding 127 articles not related to PICO, resulting in a final selection of 7 articles. A meta-analysis showed that lavender oil produces a 1.56-point reduction in women's dysmenorrhea when compared to a placebo group. Aromatherapy with lavender oil alone has been shown to be effective in reducing dysmenorrhea.

Keywords: *Aromatherapy, Dysmenorrhea, Lavender oil, Systematic review.*

1. Introduction

Dysmenorrhea is the most common gynecologic disorder in women of childbearing age and is categorized into primary and recurrent dysmenorrhea based on etiology. Primary dysmenorrhea is defined as monthly menstruation accompanied by cramping pain in the lower abdomen with a normal ovulation cycle in the absence of pelvic disease Vincenzo De Sanctis, et al. [1] and is associated with an overproduction of prostaglandins in the endometrium. It usually begins 6 to 12 months after menarche, and often begins a few hours before or at the same time as menstruation, lasts for 2-3 days, and is often accompanied by nausea, vomiting, diarrhea, and headache [2].

The prevalence of primary dysmenorrhea peaks in the late teens or early 20s Latthe, et al. [3] and is reported in 50-90% of women of reproductive age [4]. While dysmenorrhea is not life-threatening, severe cases can have a negative impact on a woman's quality of life, including activity limitations and school absences [5]. Previous studies have reported prevalence rates of primary dysmenorrhea in adolescents as high as 84% in Turkey Aktaş [6] and 73.2% in Iran, with 15% of adolescents reporting missing 1-7 days of school due to dysmenorrhea [7]. In addition, 60% of Canadian women reported experiencing primary dysmenorrhea, with 51% reporting activity limitations and 17% missing school or work [8].

Aromatherapy, the therapeutic use of concentrated essences extracted from plants, is a widely used complementary and alternative therapy used worldwide to manage a variety of conditions [9, 10]. Aromatherapy is the process of using essential oils extracted from plants to produce physiological or pharmacological effects through olfaction or skin absorption [11]. It is a non-invasive method that directly affects the brain and has the advantages of being easily accessible, convenient to use, can be used at any time and place, and has rapid effects and few side effects [11]. Among several essential oils, lavender has been reported to be a good alternative for the treatment of anxiety, stress, and depression, and can also be used as a powerful sedative Attarha, et al. [12] which could lead to the development of pain treatment and palliative care. Conditions for which interventions using lavender essential oil have

been shown to be significantly beneficial in pain management include labor pain Buckle, et al. [9] dysmenorrhea Bakhtshirin, et al. [13] and musculoskeletal pain [14]. In another study, a cohort of 118 elderly patients with chronic pain of various non-malignant origins showed a significant reduction in pain intensity when lavender aromatherapy hand massage was applied Cino [15] and lavender oil massage proved useful in relieving symptoms in 70 patients with restless legs syndrome due to chronic renal failure [16].

These studies suggest that aromatherapy with lavender oil may be suitable for women with dysmenorrhea, and we aim to confirm this. However, there is a wide range of variability and differences between studies in terms of the method, type, amount, and duration of use of aromatic oils, which limits their application in clinical practice. Therefore, the purpose of this study is to systematically review the evidence-based effect of aromatherapy with lavender oil on dysmenorrhea and determine its effectiveness as an available nursing intervention. This study is potentially useful for health professionals and women who are working to reduce dysmenorrhea symptoms and improve their quality of life.

2. Methods

2.1. Study Design

This study is a systematic review analyzing experimental studies that tested the effectiveness of aromatherapy with lavender oil on primary dysmenorrhea.

2.2. Key Questions (PICO-SD)

Patients: This study included women of childbearing age and excluded women with genital diseases, chronic diseases, and mental illness. *Intervention:* Studies were selected that analyzed the effects of lavender oil absorbed into the body through the skin, respiratory tract, or orally, using aromatic extracts or essential oils, with no restrictions on the form of aromatherapy or duration of treatment. Specific inclusion criteria were 1) Studies that applied aromatherapy using lavender oil, 2) Studies that used a blend of lavender oil and other types of oils, but in the comparison group, the other types of oils were used alone. *Comparator:* The comparator interventions for this study were a control group that did not provide aromatherapy and a comparison group that applied a placebo oil other than lavender oil. *Outcome:* The outcome of the intervention was to determine the effect of aromatherapy using lavender oil on primary dysmenorrhea, and pain measured by visual analog scale (VAS) and other validated scales was selected and analyzed as the intervention outcome. *Study Design:* The study design of this study was based on randomized controlled trials (RCTs).

2.3. Data Sources, Selection and Extraction

The literature search was conducted by searching all available literature before August 8, 2024. The international databases utilized for the search were Pubmed, Cumulative Index of Nursing and Allied Health Literature, and Cochrane Central Register of Controlled Trials, and the domestic databases were Research Information Service System, Korean Studies Information Service System, and DBpia, and the journal articles published through DBpia were searched manually using Google scholar. The search formula used MeSH (Medical Subject Headings) terms and text words with Boolean operators AND, OR, and truncation searches as appropriate, and sensitivity was increased by using filters such as 'clinical trials' and 'text word' by database.

For this study, the retrieved literatures were independently reviewed and screened by two researchers based on the key questions and inclusion and exclusion criteria. In case of disagreement, the literature was selected through discussion and a third researcher's opinion, and the PRISMA 2020 flow chart was used to describe the step-by-step literature selection process. A total of 174 articles were retrieved from the literature search, of which 158 articles, excluding 16 duplicates, were reviewed by two researchers, focusing on titles and abstracts. As a result, 31 articles were preliminarily screened out of 127, including studies that were not related to the core question and studies whose research design

did not meet the selection criteria. The 31 primary screened articles were reviewed using the same criteria and process, focusing on the full text, and a total of 7 articles were secondarily screened. Five randomized controlled trials with outcome variables presented as mean and standard deviation were meta-analyzed for quantitative analysis (Figure 1).

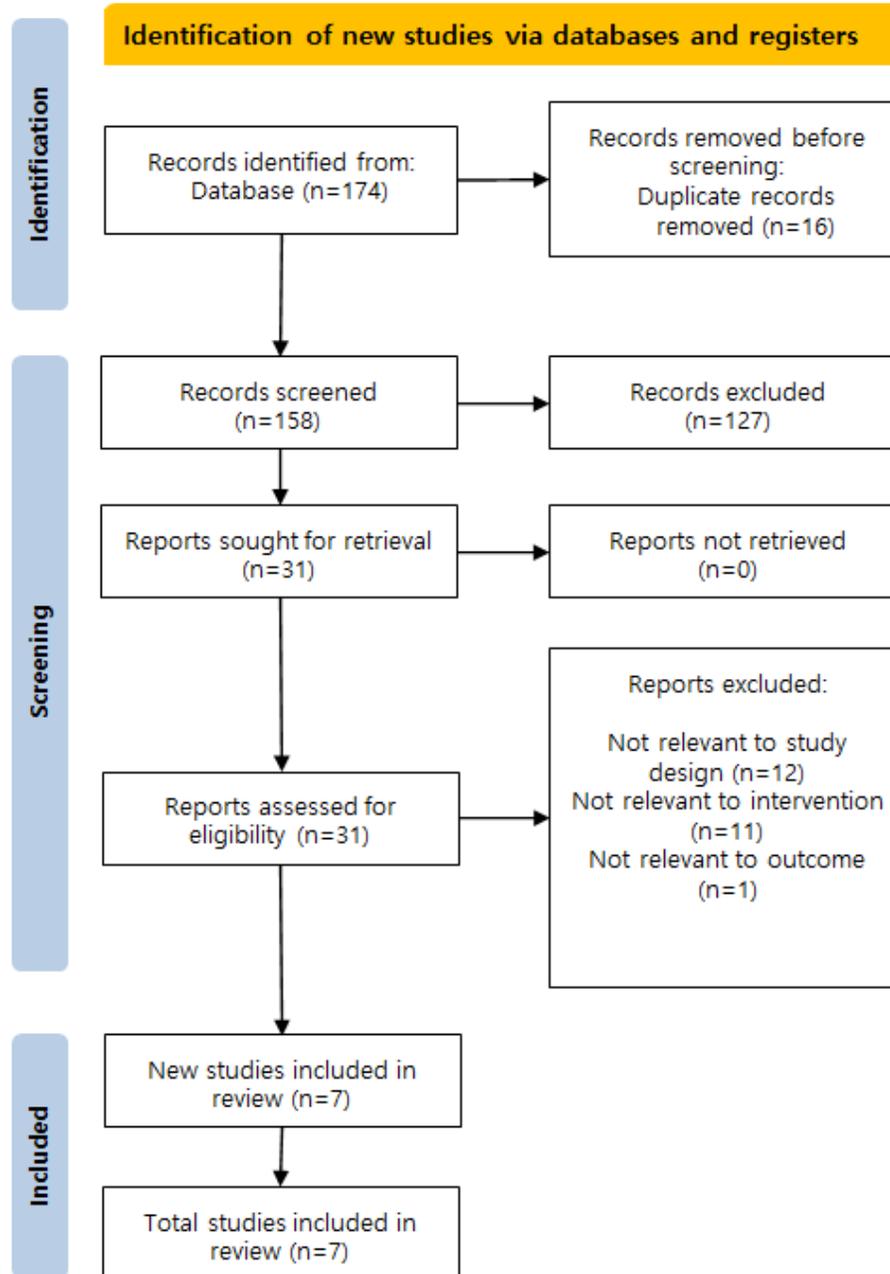


Figure 1.
Study flow chart of study selection process.

2.4. Risk of Bias Assessment

In this study, we conducted a critical review of the literature using the Cochrane Risk of Bias (RoB), a quality assessment tool for randomized controlled trials. The methodology assessed the risk of bias for six quality items as low, unclear, or high, where low indicates a low risk of bias, unclear indicates an uncertain risk of bias, and high indicates a high risk of bias.

2.5. Data Synthesis

The systematic identification, synthesis, statistical merging, and reporting of results of the selected studies were analyzed according to the Cochrane Handbook, and effect sizes were analyzed using RevMan software 5.4. The selected studies were analyzed using a random-effects model because of the heterogeneity in terms of intervention methods. In addition, because of the continuous nature of the outcome variables, the mean and standard deviation were used, and the standardized mean difference (SMD) was used. The effect and 95% confidence interval (95% CI) of each outcome variable were analyzed using the inverse variance method.

To determine the heterogeneity of the studies, the Higgins I²-statistic was used as a statistical test to determine the heterogeneity of the studies, which was visualized through forest plots to identify commonalities in confidence intervals and effect estimates across studies. An I²-value of 25% was considered low heterogeneity, 50% heterogeneity was considered moderate, and 75% or more was considered high heterogeneity, and subgroup analyses were performed to explore the causes of moderate or higher heterogeneity.

3. Results

Based on the inclusion and exclusion criteria for this study, the characteristics of the seven studies included in the systematic review [13, 17-22]. Were as follows Table 1.

Table 1.

Summary of Randomized Controlled Trials examining lavender oil on primary dysmenorrhea (n=7).

First author (year)	Participants	Intervention group(regime)	Control group (regime)	Main outcome measures	Inter-group difference	Author's conclusion
Ahmadi, et al. [17]	90 University students	(A) Lavender(50mg) – Ginger(250mg) capsule, 6hr, 3days (menstruation 1 st ~ 3 rd day) (n=30)	(B) Ginger (250mg) capsule, 6hr, 3days (menstruation 1 st ~ 3 rd day) (n=28) (C) Mefenamic acid(250mg) capsule, 6hr, 1-3days (n=29)	Pain-VAS	(A)(B) <i>P</i> =0.004 (A)(C) <i>P</i> =0.001 (B)(C) <i>P</i> =0.003	“Ginger-lavender significantly reduced the duration and severity of menstrual pain and was more effective than only ginger and mefenamic acid.”
Azima, et al. [18]	102 women (VAS≥5)	(A) Lavender oil abd. massage, 2 days (menstruation 1 st , 2 nd day), 1time, 15min (n=38)	(B) Exercise, 5 day(menstruation), 2times (n=30) (C) No treatment (n=34)	Pain-VAS	<i>p</i> <0.05	“Lavender oil massage therapy were effective in reducing some symptoms of dysmenorrhea.”
Bakhtshirin, et al. [13]	80 female students	(A) Lavender oil abd. massage, 1 day (menstruation	(B) Placebo oil abd. massage, 1 day (menstruation 1 st day), 1time,	Pain-VAS	<i>p</i> <0.001	“Findings of this study showed that lavender oil massage decreases primary

		1 st day), 1time, 15min (n=80)	15min (n=80)			dysmenorrhea and it can be used as an effective herbal drug.”
Fasanghari, et al. [20]	71 women (VAS≥6)	(A) Lavender oil abd. massage, 3days (menstruation 1 st ~ 3 rd day), 1time, 30min, 2cycle (n=24)	(B) Paraffin oil abd. massage, 3days (menstruation 1 st ~ 3 rd day), 1time, 15min, 3cycle (n=24) (C) Abd. massage, 3days (menstruation 1 st ~ 3 rd day), 1time, 15min, 3cycle (n=23)	Pain-VAS	$p<0.001$	“Massage with lavender oil is effective in reducing dysmenorrhea and suggested to be used in the management of dysmenorrhea.”
Nikjou, et al. [21]	200 female students	(A) Lavender oil inhalation, 3day (menstruation 1 st ~ 3 rd day), 1time, 15min, 3cycle (n=100)	(B) Placebo oil inhalation, 3day (menstruation 1 st ~ 3 rd day), 1time, 15min, 3cycle (n=100)	Pain-VAS	$p<0.001$	“Using lavender aromatherapy for 2 months may be effective in decreasing the pain severity of primary dysmenorrhea.”
Dehkordi, et al. [19]	96 female students (4 score ≥2)	(A) Lavender oil inhalation 3day (menstruation 1 st ~ 3 rd day) 1 time, 5min (n=48)	(B) Placebo inhalation 3day (menstruation 1 st ~ 3 rd day) 1 time, 5min (n=48)	Pain-1~4 score	$p<0.001$	“This study showed that lavender inhalation was effective in alleviating dysmenorrhea symptoms..”
Zayeri, et al. [22]	96 female students	(A) Lavender oil inhalation 3day (menstruation 1 st ~ 3 rd day) 6 time, 5min (n=48)	(B) Placebo inhalation 3day (menstruation 1 st ~ 3 rd day) 6 time, 5min (n=48)	Pain-VAS	$p<0.001$	“It could be concluded that lavender inhalation can decrease primary dysmenorrhea.”

The quality assessment of the literature for the six randomized controlled trials was as follows (Figure 2). Most studies showed no bias, suggesting that the included studies followed a preset protocol. The unique aromatherapy nature of oils makes it difficult to blind participants, researchers, and outcome assessors; nevertheless, there were studies that performed double-blinding, which was possible by applying the aromatherapy oil in the same bottle or using a placebo group with a similar oil to the aromatherapy oil.

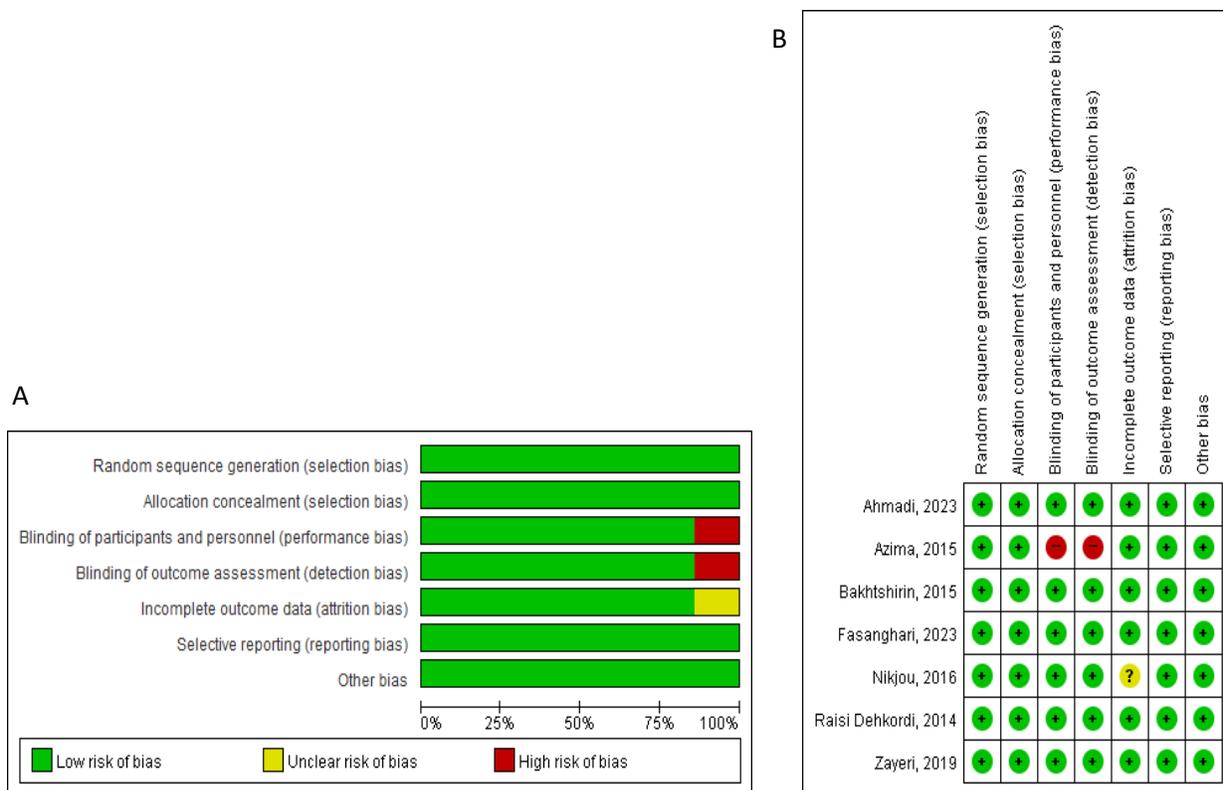


Figure 2. Reviewing authors' judgements about each risk of bias item presented as percentages across all included studies. A) Risk of bias graph, B) risk of bias summary.

Of the seven studies analyzed, five were eligible for meta-analysis [13, 17, 20-22]. And analyzed the effect size of aromatherapy with lavender oil on dysmenorrhea in women of childbearing age with a total of 561 participants (Figure 3). When the lavender oil treatment and placebo groups were analyzed, dysmenorrhea was reduced by 1.56 points (SMD=-1.56; 95% CI -1.92 to -1.20), and the effect size between the experimental and control groups was statistically significant ($Z=8.52$, $p<.001$), with high heterogeneity (Higgin's $I^2=73.5\%$). To explore the sources of heterogeneity, we conducted subgroup analyses according to intervention method (Figure 3). The massage intervention reduced dysmenorrhea by 1.46 points (SMD=-1.46; 95% CI -1.77 to -1.15), with no heterogeneity (Higgin's $I^2=0\%$). The inhalation intervention reduced dysmenorrhea by 1.88 points (SMD=-1.88; 95% CI -2.33 to -1.43), with moderate heterogeneity (Higgin's $I^2=57\%$).

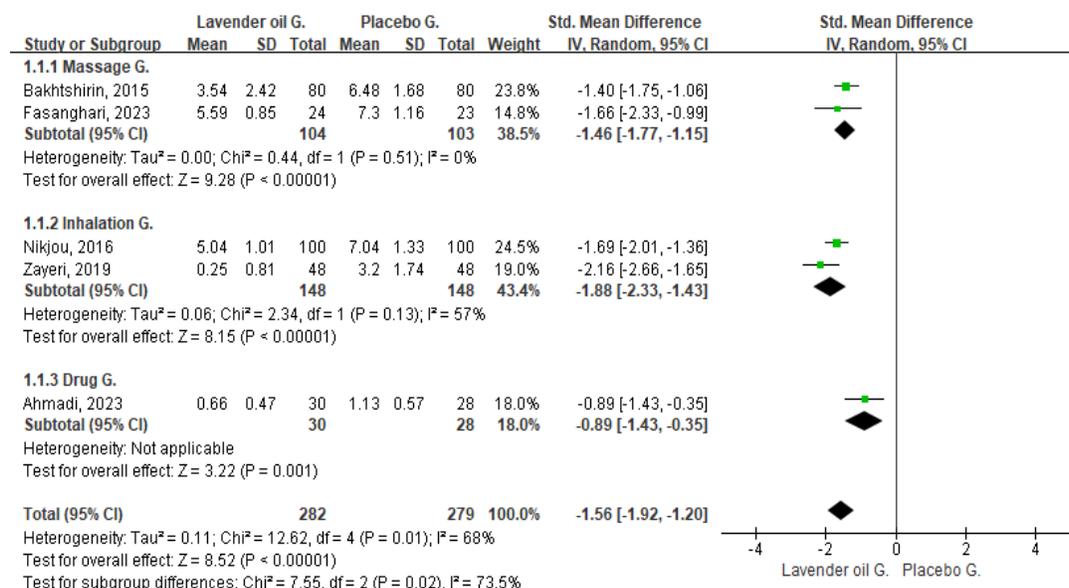


Figure 3.

Forest plot of standard error by standardized mean difference: Lavender oil G. versus Placebo G. outcome Dysmenorrhea.

4. Discussion

This review identified a total of seven studies confirming the effectiveness of lavender oil for primary dysmenorrhea. Five studies, including 561 subjects, were included in a meta-analysis to examine the intervention effects of lavender oil, and a discussion of the key findings follows.

Lavender oil is the most frequently used essential oil in research, and Sköld, et al. [23] reported that linalool acetate in lavender can stimulate the parasympathetic nervous system. The components linalool and linalyl acetate have been shown to have topical analgesic effects, and aceto-linalool has been shown to have antispasmodic effects and may increase local blood flow [23]. Furthermore, a study by Davari et al (2014) reported that the effectiveness of lavender was equivalent to that of mefenamic acid in terms of reducing the severity and duration of dysmenorrhea Davari and Mosharraf [24] and aromatherapy with lavender was found to have a stronger effect on dysmenorrhea than aromatherapy with mint and lavender or rosemary [25]. In addition, Abbasijahromi, et al. [26] studied the effect of lavender scent on cesarean section pain and reported that lavender oil treatment had a significant effect on cesarean section pain Abbasijahromi, et al. [26] and Izadi, et al. [27] reported that lavender oil application significantly reduced catheterization pain in hemodialysis patients [27]. These studies support the findings of the present study and suggest that lavender oil alone may be effective for a variety of pain conditions, not just dysmenorrhea.

The study found that inhalation with lavender oil had the largest effect size. The olfactory nerve is the only cranial nerve that is directly exposed to external stimuli, and it has been reported that it projects directly to the cerebral cortex and can be strongly stimulated [28]. In a systematic review of the effects of aromatherapy on dysmenorrhea, Lee, et al. [29] reported that inhalation of aromatic oils produced greater pain reduction than massage [29]. However, the aromatic oils used in Lee et al.'s study were varied and included Clinical Controlled Trials (CCTs), making the evidence unreliable. In addition, a study by Seyyed-Rasooli, et al. [30] reported that massage and inhalation with aromatic oils were effective in reducing pain in burn patients, but massage was slightly more effective in reducing pain [30]. Therefore, studies comparing the effectiveness of inhalation and massage in reducing pain are needed, and studies analyzing whether there are differences depending on the nature of the pain are needed.

One study of lavender capsules reported that the experimental group taking lavender-ginger

capsules had significantly lower dysmenorrhea scores than the placebo group taking ginger capsules and the control group taking mefenamic acid. A study by Davari and Mosharraf [24] also reported the effectiveness of lavender. Davari and Mosharraf [24] and [30] reported that fennel oil and rose extract, but not lavender, reduced dysmenorrhea. Lee, et al. [29] which partially supports our findings. However, although lavender is reported to be a safe oil, the possibility of chronic toxicity in the kidneys and liver as a result of long-term use of certain aromatic oils cannot be ruled out. Therefore, although the results of the present analysis confirm the effectiveness of oral consumption of lavender, further studies are needed to determine the safety of the intervention in terms of potential side effects. It is suggested that further studies with a larger number of samples be conducted in the future to obtain more accurate results.

This study is significant in that it is a systematic review and meta-analysis of studies on the use of lavender oil in women with dysmenorrhea, and it synthesizes the results of studies that have individually reported on the effectiveness of lavender oil. In particular, it was found that lavender oil monotherapy was effective in reducing dysmenorrhea, and that inhalation was the most effective of the various methods.

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Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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References

- [1] M. Vincenzo De Sanctis *et al.*, "Primary dysmenorrhea in adolescents: prevalence, impact and recent knowledge," *Pediatric Endocrinology Reviews (PER)*, vol. 13, no. 2, pp. 465-73, 2015.
- [2] K. J. Berkley, "Primary dysmenorrhea: an urgent mandate," *Pain*, vol. 1, no. 1, p. 8, 2013.
- [3] P. Latthe, L. Mignini, R. Gray, R. Hills, and K. Khan, "Factors predisposing women to chronic pelvic pain: systematic review," *Bmj*, vol. 332, no. 7544, pp. 749-755, 2006. <https://doi.org/10.1136/bmj.38748.697465.55>.
- [4] J. Berek and E. Novak, *Berek & novak's gynecology*. Philadelphia, USA: Lippincott Williams & Wilkins, 2007.
- [5] S. Iacovides, I. Avidon, and F. C. Baker, "What we know about primary dysmenorrhea today: a critical review," *Human reproduction update*, vol. 21, no. 6, pp. 762-778, 2015. <https://doi.org/10.1093/humupd/dmv039>.
- [6] D. Aktaş, "Prevalence and factors affecting dysmenorrhea in female university students: effect on general comfort level," *Pain Management Nursing*, vol. 16, no. 4, pp. 534-543, 2015. <https://doi.org/10.1016/j.pmn.2014.10.004>.
- [7] Z. Panahande, Z. Pakzad, and R. Ashoori, "Survey the prevalence, knowledge and practice of Guilan University students about dysmenorrhea," *Journal of Guilan University of Medical Sciences*, vol. 17, no. 66, pp. 87-94, 2008.
- [8] M. A. Burnett *et al.*, "Prevalence of primary dysmenorrhea in Canada," *Journal of Obstetrics and Gynaecology Canada*, vol. 27, no. 8, pp. 765-770, 2005. [https://doi.org/10.1016/S1701-2163\(16\)30728-9](https://doi.org/10.1016/S1701-2163(16)30728-9).
- [9] J. Buckle, K. Ryan, and K. B. Chin, "Clinical Aromatherapy for Pregnancy, Labor and Postpartum," *International Journal of Childbirth Education*, vol. 29, no. 4, pp. 21-27, 2014.
- [10] E. Varney and J. Buckle, "Effect of inhaled essential oils on mental exhaustion and moderate burnout: a small pilot study," *The Journal of Alternative and Complementary Medicine*, vol. 19, no. 1, pp. 69-71, 2013.
- [11] A. J. Farrar and F. C. Farrar, "Clinical aromatherapy," *The Nursing Clinics of North America*, vol. 55, no. 4, p. 489, 2020.
- [12] M. Attarha, K. Vakillian, N. Rozbahany, and R. Bekhradi, "Effect of perineal massage with lavender essence on episiotomy and laceration," *Journal of Babol University of Medical Sciences*, vol. 11, no. 4, pp. 25-30, 2009.
- [13] F. Bakhtshirin, S. Abedi, P. YusefiZoj, and D. Razmjooee, "The effect of aromatherapy massage with lavender oil on severity of primary dysmenorrhea in Arsanjan students," *Iranian journal of nursing and midwifery research*, vol. 20, no. 1, pp. 156-160, 2015.

- [14] A. Nasiri, M. A. Mahmodi, and Z. Nobakht, "Effect of aromatherapy massage with lavender essential oil on pain in patients with osteoarthritis of the knee: A randomized controlled clinical trial," *Complementary therapies in clinical practice*, vol. 25, pp. 75-80, 2016.
- [15] K. Cino, "Aromatherapy hand massage for older adults with chronic pain living in long-term care," *Journal of Holistic Nursing*, vol. 32, no. 4, pp. 304-313, 2014.
- [16] S. H. Hashemi, A. Hajbagheri, and M. Aghajani, "The effect of massage with lavender oil on restless leg syndrome in hemodialysis patients: a randomized controlled trial," *Nursing and midwifery studies*, vol. 4, no. 4, p. e29617, 2015. <https://doi.org/10.17795/nmsjournal29617>
- [17] S. Ahmadi, S. Jannesari, M. Nasiri, and S. Sahranavard, "Comparing the Effect of Ginger-Lavender, Ginger and Mefenamic Acid Capsules on the Severity of Primary Dysmenorrhea among University Students: A Triple-Blind Clinical Trial," *Journal of Midwifery & Reproductive Health*, vol. 11, no. 2, pp. 3725-3733, 2023. <https://doi.org/10.22038/JMRH.2022.63243.1815>
- [18] S. Azima, H. R. Bakhshayesh, M. Kaviani, K. Abbasnia, and M. Sayadi, "Comparison of the effect of massage therapy and isometric exercises on primary dysmenorrhea: A randomized controlled clinical trial," *Journal of pediatric and adolescent gynecology*, vol. 28, no. 6, pp. 486-491, 2015. <http://dx.doi.org/10.1016/j.jpag.2015.02.003>
- [19] Z. R. Dehkordi, F. S. H. Baharanchi, and R. Bekhradi, "Effect of lavender inhalation on the symptoms of primary dysmenorrhea and the amount of menstrual bleeding: A randomized clinical trial," *Complementary therapies in medicine*, vol. 22, no. 2, pp. 212-219, 2014. <http://dx.doi.org/10.1016/j.ctim.2013.12.011>
- [20] M. Fasanghari, M. Larki, A. Esmaeili-Hesari, S. Alirezaei, M. Ramezanzadeh, and M. Tafazoli, "The Effect of Aromatherapy Massage with Lavender Oil on the Severity of Primary Dysmenorrhea among University Students: A Randomized Clinical Trial," *Journal of Midwifery & Reproductive Health*, vol. 11, no. 1, pp. 3592-3601, 2023. <https://doi.org/10.22038/jmrh.2022.62282.1751>
- [21] R. Nikjou, R. Kazemzadeh, M. Rostamnegad, S. Moshfegi, M. Karimollahi, and H. Salehi, "The effect of lavender aromatherapy on the pain severity of primary dysmenorrhea: A triple-blind randomized clinical trial," *Annals of medical and health sciences research*, vol. 6, no. 4, pp. 211-215, 2016. https://doi.org/10.4103/amhsr.amhsr_527_14
- [22] F. Zayeri, Z. R. Dehkordi, and F. S. Hosseini-Baharanchi, "The clinical efficacy of lavender oil inhalation on intensity of menstrual pain from primary dysmenorrhea," *Journal of Herbmed Pharmacology*, vol. 8, no. 3, pp. 218-223, 2019. <https://doi.org/10.15171/jhp.2019.32>
- [23] M. Sköld, L. Hagvall, and A. T. Karlberg, "Autoxidation of linalyl acetate, the main component of lavender oil, creates potent contact allergens," *Contact dermatitis*, vol. 58, no. 1, pp. 9-14, 2008. <https://doi.org/10.1111/j.1600-0536.2007.01262.x>
- [24] M. Davari and S. Mosharraf, "Aromatherapy effect of lavender essence and mefenamic acid on dysmenorrhea: A clinical trial," *Journal of Research Development in Nursing and Midwifery*, vol. 11, no. 2, pp. 8-14, 2014.
- [25] K. Mousavi Kani, Z. Mirzania, F. Mirhaghjoo, R. Mousavi Nezhad, S. Akbarzadeh, and M. Jafari, "The effect of aromatherapy (with lavender) on dysmenorrhea: a systematic review and meta-analysis," *Journal of Pediatric Perspectives*, vol. 7, no. 7, pp. 9657-9666, 2019.
- [26] A. Abbasjahromi *et al.*, "Compare the effect of aromatherapy using lavender and Damask rose essential oils on the level of anxiety and severity of pain following C-section: A double-blinded randomized clinical trial," *Journal of Complementary and Integrative Medicine*, vol. 17, no. 3, pp. 1-14, 2020. <https://doi.org/10.1515/jcim-2019-0141>
- [27] F. Izadi *et al.*, "The effect of aromatherapy with lavender on pain of needle insertion and severity of restless legs syndrome in hemodialysis patients; A systematic review and meta-analysis," *Archives of academic emergency medicine*, vol. 12, no. 1, p. e4, 2023.
- [28] J. Buckle, *Clinical Aromatherapy E-Book: Clinical Aromatherapy E-Book*. Elsevier Health Sciences, 2003.
- [29] M. S. Lee, H. W. Lee, M. Khalil, H. S. Lim, and H.-J. Lim, "Aromatherapy for managing pain in primary dysmenorrhea: A systematic review of randomized placebo-controlled trials," *Journal of clinical medicine*, vol. 7, no. 11, p. 434, 2018. <https://doi.org/10.3390/jcm7110434>
- [30] A. Seyyed-Rasooli, F. Salehi, A. Mohammadpoorasl, S. Goljaryan, Z. Seyyedi, and B. Thomson, "Comparing the effects of aromatherapy massage and inhalation aromatherapy on anxiety and pain in burn patients: A single-blind randomized clinical trial," *Burns*, vol. 42, no. 8, pp. 1774-1780, 2016. <https://doi.org/10.1016/j.burns.2016.06.014>