



# The use of aromatherapy in primary dysmenorrhea

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## ABSTRACT

**Objective:** The purpose of this review is to determine the use of aromatherapy in primary dysmenorrhea. **Method:** This is a literature review by searching article databases through Google Scholar, PubMed, ScienceDirect, Microsoft Academic, ProQuest, Semantic Scholar. The selection period for article publication is from 2015 to 2021. A total of 96 articles were obtained, and 30 articles could be entered according to the inclusion criteria.

**Results:** Thirty articles were analyzed, it is shown that aromatherapy effectively reduces the intensity of primary dysmenorrheal pain. The sample size of the 30 articles varied from 16 samples to 200 research samples, and the research design used experiments, clinical trials, and ex vivo, in vivo, and in vitro studies.

**Conclusion:** Aromatherapy is an effective alternative intervention that can be used to reduce the intensity of primary dysmenorrhea pain.

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## Introduction

Dysmenorrhea is a common problem experienced by most women that need to be addressed.<sup>1</sup> Dysmenorrhea is defined as menstrual pain feeling cramps in the lower abdomen originating from the uterus, classified into two, namely primary dysmenorrhea that occurs in the absence of pathology and secondary dysmenorrhea that occurs in the presence of pathology.<sup>2</sup> The discomfort felt from menstrual pain affects daily activities.<sup>3</sup> For most young women, it is the cause of absenteeism from college/school.<sup>4</sup>

Several studies regarding the prevalence of dysmenorrhea in various countries, namely from a total of 20.813, are 71.1% experiencing dysmenorrhea.<sup>5</sup> In a study in Ghana, the prevalence of dysmenorrhea was 68.1%, with the majority of the mean age 16–19 years with pain lasting more than 3 days.<sup>6</sup> On the other hand, a study in North Central Ethiopia stated that 62.3% of women experienced primary dysmenorrhea that hindered daily activities, with the majority experiencing severe pain.<sup>7</sup> The intense pain experienced during menstruation can limit daily activities.<sup>8</sup>

In managing dysmenorrhea, some women choose to consult a health professional about their condition, and some claim to use analgesic drugs to relieve dysmenorrhea pain without ever consulting a health professional.<sup>8</sup> In addition to pharmacological treatment options, there are non-pharmacological treatment options as alternative therapies to complementary medicine.<sup>9</sup>

Complementary pain therapies include respiratory relaxation, essential oils, aromatherapy, music therapy, acupuncture, and acupressure. Complementary therapies can reduce pain and improve quality of life.<sup>10</sup>

Aromatherapy is a therapy that uses essential oils as aromatics from extracted plants to improve the health of the body, mind, and spirit.<sup>11</sup> Aromatherapy can be an alternative used to treat dysmenorrhea.<sup>12</sup> The purpose of this review is to determine the use of aromatherapy in primary dysmenorrhea.

## Method

This article is a literature review conducted to find out about aromatherapy as an alternative therapy in primary dysmenorrhea. The method used is a literature review with international and national literature searches carried out using a database. Search databases of relevant articles on aromatherapy in primary dysmenorrhea were identified by searching for articles through Google Scholar, PubMed, ScienceDirect, Microsoft Academic, ProQuest, Semantic Scholar. The selection period for the publication of the article is from 2015 to 2021. The search keywords used are “aromatherapy,” “dysmenorrhea,” “essential oil,” and “menstrual pain.” Search in English and Indonesian, which are considered relevant to the topic of discussion to be entered. The total articles obtained were 96 articles relevant to the title, then the articles retrieved in the search were filtered based on the relevant titles and abstract contents. With the inclusion criteria, namely: the article contains about aromatherapy used in dysmenorrhea, the research subject has dysmenorrhoea, and the article must contain full-text, the exclusion criteria are systematic review articles with meta-analysis, 30 articles met the inclusion criteria (Table 1).

Fig. 1.

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**Table 1**  
Analysis of aromatherapy articles on primary dysmenorrhea.

Author (year)	Research design and sample	Interventions provided	Research measurement tools	Research result
Nikjou et al. (2016) <sup>13</sup>	Triple-blinded randomized clinical trial 200 female students with primary dysmenorrhea	Three drops of lavender essential oil and three drops of diluted milk are given to a cotton swab by inhalation three times/day for 30 min in the first three days of menstruation	Questionnaire VAS	Lavender aromatherapy was effective in reducing menstrual pain ( $P < 0.001$ )
Hanfy et al. (2020) <sup>14</sup>	40 women with primary dysmenorrhea	Progressive relaxation training Aromatherapy lavender and rosemary Aroma Given 3 times/week for 8 weeks	VAS	Progressive relaxation training and aromatherapy are effective in reducing menstrual pain
Purwati (2018) <sup>15</sup>	Pre-experimental design with time series design 40 students who experience menstrual pain	Effleurage massage with 2 drops of lavender essential oil and 1 ml of olive oil, performed for 10 min pre and post-test with an interval of 6 h	NRS	Effleurage massage with lavender aromatherapy in relieving menstrual pain ( $P < 0.000$ )
Ari Adiputri et al. (2018) <sup>16</sup>	Pre-experimental design with time series design 42 students with primary dysmenorrhea	Lavender essential oil therapy with effleurage massage four observations for 6 h	VAS	Administration of lavender essential oil therapy with effleurage massage was effective in reducing the intensity of dysmenorrhoea pain ( $P < 0.05$ )
Pujiati et al. (2019) <sup>17</sup>	Randomized pretest-posttest design 84 students with primary dysmenorrhea	Aromatherapy lavender, clary sage, ginger, geranium with effleurage massage Lavender aromatherapy With effleurage massage Performed for 3 min at minute 5, 10, 15 and 25	NRS	Giving lavender, clary sage, ginger, geranium aromatherapy with effleurage massage was more effective in reducing dysmenorrhea pain than lavender aromatherapy with effleurage massage ( $P < 0.001$ )
Thenmozhi and Bhuvaneshwari (2020) <sup>18</sup>	Pre-experimental design Sixty adolescent girls with primary dysmenorrhea	Inhalation of lavender aromatherapy on the 7th day of the menstrual cycle for 2 menstrual cycles with a post-test on the first day of menstruation	NRS	Lavender aromatherapy is effective in reducing menstrual distress in primary dysmenorrhea ( $P < 0.001$ )
Hamranani and Sari (2020) <sup>19</sup>	Pre-experimental with one group pretest post-test design 16 teenage girls with primary dysmenorrhea	Aromatherapy lavender 3–5 drops for 5 min on the 2nd day of menstruation	NRS	Lavender aromatherapy is effective in reducing menstrual pain ( $P < 0,05$ )
Zayeri et al. (2019) <sup>20</sup>	Double-blinded randomized clinical trial 96 students with primary dysmenorrhea	Aromatherapy lavender 3 drops in the palm of the hand by inhalation for 5 min with a distance of 7–10 cm from the nose, every 6 h for 3 days	VAS	Lavender aromatherapy was effective in reducing menstrual pain ( $P < 0.001$ )
Pramita et al. (2020) <sup>21</sup>	Quasi-experimental with one group pre-posttest design 38 female students with primary dysmenorrhea	Lavender aromatherapy 2–4 drops of the lower abdomen with a massage for 10 min performed 1 time/day for 3 days	Questionnaire	Lavender aromatherapy can reduce menstrual pain ( $P < 0.05$ )
Ertiana and Pratami (2021) <sup>22</sup>	Quasi-experimental with nonequivalent control group design 22 adolescent girls with primary dysmenorrhea	Aromatherapy lavender 2 drops on the back of the hand and inhale for 10 min	Questionnaire	Lavender aromatherapy can reduce dysmenorrhoea pain ( $P < 0.05$ )
Sabrina et al. (2020) <sup>23</sup>	Quasi-experiment with one group pretest and post-test 31 students with primary dysmenorrhea	Lavender aromatherapy	NRS	There is an effect of lavender aromatherapy on reducing dysmenorrhoea pain ( $P < 0.05$ )
Nurak et al. (2020) <sup>24</sup>	Quasi-experiment with no control group 40 students with primary dysmenorrhea	Aromatherapy lavender jasmine 4–5 drops into 10 ml water for 10 minutes	NRS	Lavender and jasmine aromatherapy was effective in reducing dysmenorrhoea pain ( $P < 0.001$ )
Azizah (2019) <sup>25</sup>	Quasi-experiment with pre-post test nonequivalent control group design 30 adolescent girls with primary dysmenorrhea	Lavender aromatherapy inhalation	VAS	Lavender aromatherapy can reduce menstrual pain ( $P < 0.002$ )
Savitri dan Hardyanti (2019) <sup>26</sup>	Pre-experimental design with one group pretest posttest 34 students with primary dysmenorrhea	Inhalation of lavender aromatherapy 3 drops mixed with 20 ml of water	NRS	There was a decrease in the intensity of dysmenorrhoea pain using lavender aromatherapy ( $P < 0.05$ )
Sun et al. (2017) <sup>27</sup>	60 female rats induced by oxytocin	Cinnamomum cassia essential oil	ELISA kit and Power Lab recording system	Cinnamomum cassia essential oil can inhibit uterine smooth muscle contraction so that it can be used to reduce the pain intensity of dysmenorrhoea.

Table 1 (Continued)

Azima et al. (2015) <sup>28</sup>	Randomized controlled trial 102 students with primary dysmenorrhea	Group I: effleurage massage with lavender aromatherapy Group II: isometric exercises	VAS	Isometric exercise and massage with aromatherapy can reduce the intensity of primary dysmenorrhea
Azima et al. (2015) <sup>29</sup>	Controlled clinical trials 102 students with primary dysmenorrhea	Reflexology was 20 min/day Massage with lavender aromatherapy for 15 minutes	VAS	Aromatherapy massage and reflexology can reduce the intensity of primary dysmenorrhea pain
Dadfar (2015) <sup>30</sup>	Clinical trial 30 women with symptoms of dysmenorrhea and premenstrual syndrome	Chamomile extract 30 drops in a glass of water/8 h for 3 days	Questionnaire Daily Record of Severity of Problems (DRSP)	Chamomile extract can reduce dysmenorrhea pain and premenstrual syndrome symptoms
Ataollahi et al. (2015) <sup>31</sup>	Double-blind clinical trial 110 students with primary dysmenorrhea	Rosaceous essential oil 10 drops 2 times/day for the first 3 days of menstruation	Questionnaire	Rosaceous aromatherapy can reduce the intensity of dysmenorrhea
Chen et al. (2015) <sup>32</sup>	Animal experiments Mice with dysmenorrhea (using estradiol benzoate and oxytocin)	Essential oils (Angelica oil, Chuanxiong oil, Cyperus oil, Cinnamon oil, and Clove oil) and Ibuprofen	–	The essential oil was effective in penetrating Ibuprofen in treating dysmenorrhea ( $P < 0.05$ )
Salehian dan Safdari (2015) <sup>33</sup>	Clinical trial 100 students with primary dysmenorrhea	Belly massage with cinnamon and lavender aromatherapy Abdominal massage with placebo Performed 1 time/day for 7 days before menstruation	VAS	Abdominal massage with aromatherapy was effective in reducing menstrual pain ( $P < 0.05$ )
Bakhtshirin et al. (2015) <sup>34</sup>	Clinical trial 80 students with primary dysmenorrhea	Lavender aromatherapy massage Massage with placebo	VAS	Massage with lavender aromatherapy was more effective than a massage with placebo in reducing primary dysmenorrhea ( $P < 0.001$ )
Beiravand et al. (2015) <sup>35</sup>	Randomized clinical trial 60 students with primary dysmenorrhea	Massage with lavender essential oil 2 drops in 2.5 ml almond oil Massage with almond oil placebo 2.5 ml Performed 15 min 2 times/day for 2 menstrual cycles above the pubis	VAS	Massage with lavender aromatherapy was effective in reducing dysmenorrhea pain ( $P < 0.001$ )
Wong et al. (2020) <sup>36</sup>	Ex vivo and in vivo study Rat	Salvia sclarea essential oil	Analysis Western Blotting	Scleareol contained in Salvia sclarea essential oil can reduce dysmenorrhea
Masoudi et al. (2020) <sup>37</sup>	Case series 13 samples with primary dysmenorrhea	Qost Oil 15 drops (2.3 ml) applied 2 times/day in the zone between the navel and pubis without massage for 6 weeks	VAS	Qost essential oil is effective for controlling dysmenorrhea
Ni et al. (2021) <sup>38</sup>	In vitro studies Rat	10 essential oils Blood-activating and stasis-resolving herbs (BASRH)	Power Lab recording system	BASRH essential oil can relax uterine smooth muscles to reduce dysmenorrhea
Bi et al. (2021) <sup>39</sup>	In vivo and in vitro studies Rat	Citrus essential oil	–	The citrus essential oil can effectively reduce primary dysmenorrhea in rats
Yunianingrum et al. (2018) <sup>40</sup>	Quasi-experiment with two group comparison pretest–posttest design 44 respondents with primary dysmenorrhea	Warm compresses 2 times for 60 minutes at a temperature of 38.5 °C–40 °C using a warm water bag Lavender aromatherapy candle for 60 min	NRS	Warm compresses and lavender aromatherapy are effective in reducing the pain of dysmenorrhea
Shirooye et al. (2017) <sup>41</sup>	Single-blind randomized trial 70 students with primary dysmenorrhea	Ginger essential oil 5 drops each Ginger capsules 250 mg Given 6 h in the first 2 days of menstruation	VAS	Ginger essential oil and ginger capsules effectively relieved dysmenorrhea pain, but ginger essential oil was tolerated better than ginger capsules by respondents.
Uysal et al. (2016) <sup>42</sup>	Randomized clinical trial 100 respondents with primary	Aromatherapy rose by inhalation for 10 min	VAS	Aromatherapy with rose essential oil is effective in reducing the intensity of dysmenorrhoea pain

## Result

Based on 30 articles analyzed, it is known that aromatherapy effectively reduces the pain intensity of primary dysmenorrhea. The sample size of the 30 articles varied from 16 samples to 200 research samples, and the research design used experiments, clinical trials, and ex vivo, in vivo, and in vitro studies. In addition, there are three articles using mice as research samples.

Thirty articles were analyzed regarding the intervention that indicated that aromatherapy was administered by inhalation, oral, and dermal (massage or topical). Aromatherapy used includes lavender, clary sage, ginger, geranium, Cinnamomum cassia,

chamomile, rosaceous, angelica, chuanxiong, cyperus, clove, salvia sclarea, Saussurea costus, citrus, ginger, Curcuma phaeocaulis, Ligusticum striatum, Leonurus japonicus (rhizomes), Curcuma longa (tuberous roots), Prunus persica, Carthamus tinctorius, Siphonostegia Chinensis, Salvia miltiorrhiza and Cyathula officinalis.

## Discussion

Primary dysmenorrhea is cramping of the lower abdomen in the uterus during menstruation caused by the uterus contracting. Primary dysmenorrhea occurs due to increased uterine contractions

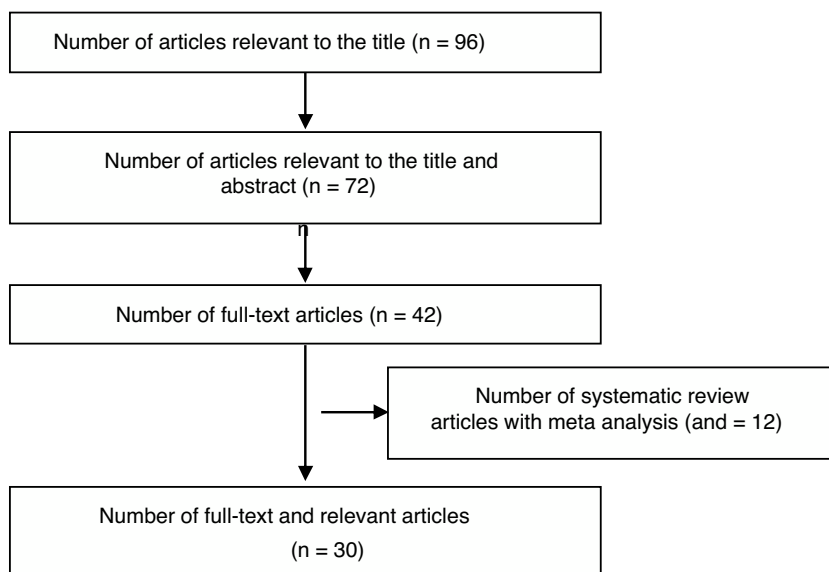


Fig. 1. Literature search flowchart.

due to excessive production and release of prostaglandins.<sup>9</sup> Due to the presence of PGF2 $\alpha$ , blood vessels, and myometrium contract and cause tissue ischemia and pain.<sup>27</sup>

There were 10 essential oils (*Curcuma phaeocaulis*, *Ligusticum striatum*, *Leonurus japonicus*, *Curcuma longa* (rhizomes), *Curcuma longa* (tuberous roots), *Prunus persica*, *Carthamus tinctorius*, *siphonostegia Chinensis*, *salvia miltiorrhiza*, *cyathula* of terpenoids, disqui-aliphatic, and phthalates, decreased contractile activity, tension, and frequency ( $P < 0.05$  or  $P < 0.01$ ). *Curcuma phaeocaulis* essential oil can inhibit the entry of extracellular Ca<sup>2+</sup> and release intracellular Ca<sup>2+</sup>, which supports uterine relaxation and can be used as an antidysmenorrhea treatment.<sup>38</sup> In line with the research results of Sun et al. (2017), the content in *Curcuma phaeocaulis* essential oil can inhibit uterine smooth muscle contraction so that it can be used as an alternative treatment for dysmenorrhea.

An aromatherapy massage is a stimulation of the skin with gentle strokes coupled with essential oils. Aromatherapy massage on body organs can absorb optimally, which causes a relaxing effect. This occurs due to increased oxygen circulation, which can reduce pain intensity.<sup>17</sup> Giving aromatherapy either by massage or inhalation can reduce menstrual pain.<sup>8</sup> Here is a decrease in the duration of pain by providing aromatherapy with a massage.<sup>28,35</sup>

Aromatherapy triggers the limbic system to stimulate the hypothalamus to produce endorphins which result in pain reduction.<sup>20,24</sup> Some essential oil molecules in the blood are able to interact with hormones or enzymes to help relieve pain.<sup>15</sup> Aromatherapy given by inhalation can reduce the pain of dysmenorrhea, and there are no side effects that occur in research subjects so that aromatherapy by inhalation is a safe treatment.<sup>13</sup> In the study of Hamranani and Sari (2020), aromatherapy given by inhalation with 3–5 drops of aromatherapy carried out for 5 min can reduce pain and reduce menstrual pain ( $P < 0.05$ ).

The content of linalyl acetate and Linalool (C<sub>10</sub>H<sub>18</sub>O) in lavender provides a relaxing effect that can reduce anxiety.<sup>26</sup> In the study of Ertiana and Pratami (2021), respondents experienced menstrual pain that often occurred on the first to a third day with risk factors for dysmenorrhea, namely the duration of menstruation, excess body weight associated with fatty tissue in the reproductive organs that inhibits blood flow and experiencing stress as a result of stress. It is Triggers the excessive production of the hormones estrogen and adrenaline related to uterine contractions. Stress reduction by

giving essential oils can be effective in improving the symptoms of primary dysmenorrhea.<sup>29</sup>

Aromatherapy is used for fragrance and healing. Lavender aromatherapy is proven to help overcome anxiety as a relaxing or calming effect that can help stress management. Chamomile aromatherapy can secrete cortisol and is an analgesic.<sup>43</sup> Nikjou et al. (2016) stated that lavender aromatherapy was effective in reducing menstrual pain. According to Hamranani and Sari (2020), by giving 3–5 drops of lavender aromatherapy by inhalation for 5 min, Savitri and Hardyanti (2019) Lavender aromatherapy 3 drop mixed with 20 ml of water by inhalation effectively reduce the pain of dysmenorrhea.

Ginger essential oil 5 drops and ginger capsules 250 mg every 6 hours in the first 2 days of menstruation effectively relieve dysmenorrhea pain, but ginger essential oil is tolerated better than ginger capsules.<sup>41</sup> In a study conducted by Pujiati, Siagian, and Hardivianty (2019), it was stated that aromatherapy of lavender, clary sage, ginger, geranium with effleurage massage performed for 3 mi at 5, 10, 15, and 25 min was effective in reducing dysmenorrhea pain but more effective than providing lavender aromatherapy alone with effleurage massage.

## Conclusion

Aromatherapy is an effective alternative intervention that can be used to reduce the pain intensity of primary dysmenorrhea. However, the results of the analysis of articles with various research designs and aromatherapy interventions may be biased. Several studies on the measurement of primary dysmenorrheal pain still use VAS and NRS. So it is still necessary to do further research with different designs, interventions, and examinations other than VAS and NRS in future studies.

## Conflicts of interest

The authors declare no conflict of interest.

## References

- Ahuja A. Impact of dysmenorrhea on quality of life of adolescent girls of Chandigarh. *J Child Adolesc Behav.* 2016;4:1–5.
- Libarle M, Simon P, Bogne V, Pintiaux A, Furet E. Management of dysmenorrhea. *Gynecologie.* 2018;39:264–72.

3. Armour M, Ferfolja T, Curry C, et al. The prevalence and educational impact of pelvic and menstrual pain in australia: a national online survey of 4202 young women aged 13–25 Years. *J Pediatr Adolesc Gynecol.* 2020;33:511–8.
4. Al-Matouq S, Al-Mutairi H, Al-Mutairi O, et al. dysmenorrhea among high-school students and its associated factors in Kuwait. *BMC Pediatr.* 2019;19:1–12.
5. Armour M, Parry K, Manohar N, et al. The prevalence and academic impact of dysmenorrhea in 21,573 young women: a systematic review and meta-analysis. *J Women's Health.* 2019;28:1161–71.
6. Acheampong K, Baffour-Awuah D, Ganu D, et al. Prevalence and predictors of dysmenorrhea, its effect, and coping mechanisms among adolescents in Shai Osudoku District, Ghana. *Obstet Gynecol Int.* 2019;2019.
7. Gileteu A, Bekele W. Prevalence and associated factors of primary dysmenorrhea among Debre Tabor university students, North Central Ethiopia. *Int J Biomed Eng Clin Sci.* 2019;4:70.
8. Parra-Fernández ML, Onieva-Zafra MD, Abreu-Sánchez A, et al. Management of primary dysmenorrhea among university students in the South of Spain and family influence. *Int J Environ Res Public Health.* 2020;17:1–13.
9. Ryan SA. The treatment of dysmenorrhea. *Pediatr Clin North Am.* 2017;64:331–42.
10. Hamlin AS, Robertson TM. Pain and complementary therapies. *Crit Care Nurs Clin North Am.* 2017;29:449–60.
11. Frost E, Ostrovsky DA. Aromatherapy may reduce menstrual pain in women with primary dysmenorrhea. *Explore.* 2019;15:241–2.
12. Song JA, Lee M-K, Min E, et al. Effects of aromatherapy on dysmenorrhea: a systematic review and meta-analysis. *Int J Nurs Stud.* 2018;84:1–11.
13. Nikjou R, Kazemzadeh R, Rostamnegad M, et al. The effect of lavender aromatherapy on the pain severity of primary dysmenorrhea: a triple-blind randomized clinical trial. *Ann Med Health Sci Res.* 2016;6:211–5.
14. Hanfy HM, Kamel HEH, Kamal WM. The effect of progressive relaxation training versus aromatherapy on primary dysmenorrhea, Egypt. *Med J Cairo Univ.* 2020;88:577–82.
15. Purwati Y. The effectiveness of effleurage massage using lavender aromatherapy for menstrual pain relief. *J Heal Med Nurs.* 2018;49:104–9.
16. Ari Adiputri NW, Darmiyanti NM, Candra IW. The effectiveness of lavender oil treatment using effleurage massage technique towards dysmenorrhea intensity of female students at Midwifery Academy of Kartini Bali. *Int J Res Med Sci.* 2018;6(6):1886–9.
17. Pujiati W, Siagian Y, Hardivianty C. Application of essential oils: lavender, clary sage, ginger and geranium as aromatherapy through effleurage massage for menstrual pain. *Int J Sci Res.* 2019;8:1476–80.
18. Thenmozhi P, Bhuvaneshwari K. Effectiveness of aromatherapy on menstrual distress among adolescent girls. *J Complement Altern Med Res.* 2020;11:25–32.
19. Hamranani SST, Sari DP. Lavender aromatherapy on alleviating menstrual pain in female teenagers: a case study on Polanharjo Klaten. In: *Proc 2nd Heal Sci Int Conf.* 2020. p. 104–9 [Hsic 2019].
20. Zayeri F, Dehkordi ZR, Hosseini-Baharanchi FS. The clinical efficacy of lavender oil inhalation on intensity of menstrual pain from primary dysmenorrhea. *J Herb Med Pharmacol.* 2019;8:218–23.
21. Pramita ASDP, Sutema IMP, Putri DWB. The effect of lavender aromatherapy on dysmenorrhea students in Institute of Health Science Medica Persada Bali. *J Pharm Sci Appl.* 2020;2:8–16.
22. Ertiana D, Pratami AN. Aromatherapy lavender to decrease dysmenorrhea in teenage girls. *J Kesehatan Prima.* 2021;15:46–56.
23. Sabrima EJ, Sanjaya R, Surmiasih, Sagita YD. Effect of lavender oil aromaterapy on menstrual pain in students at SMPN18 Pesawaran in 2020. *Biomed J Indones.* 2020;6:96–103.
24. Nurak MA, Dinah M, Tibuludji P, Muntasir P, Refli. Effectiveness of lavender (*Lavandula angustifolia*) and jasmine (*Jasminum officinale*) aromatherapy on the intensity of dysmenorrhea in student of Faculty of Public Health, Universitas Nusa Cendana, Kupang. *J Matern Child Health.* 2020;5:429–35.
25. Azizah N. Lavender aromatherapy inhalation to reduce menstrual pain in teenagers. *J Farm dan Ilmu Kesehat.* 2019;4:39–41.
26. Savitri R, Hardiyanti O. The effectiveness of lavender aromatherapy in reducing the level of dysmenorrhea in adolescent girls. *J Matern Care Reprod Health.* 2019;2:234–9.
27. Sun L, Liu L-N, Li J-C, et al. The essential oil from the twigs of cinnamomum cassia presl inhibits oxytocin-induced uterine contraction in vitro and in vivo. *J Ethnopharmacol.* 2017;206:107–14.
28. Azima S, Bakhshayesh HR, Kaviani M, Abbasnia K, Sayadi M. Comparison of the effect of massage therapy and isometric exercises on primary dysmenorrhea: a randomized controlled clinical trial. *J Pediatr Adolesc Gynecol.* 2015;28:486–91.
29. Azima S, Bakhshayesh HR, Mousavi S, Ashrafzaveh A. Comparison of the effects of reflexology and massage therapy on primary dysmenorrhea. *Biomed Res.* 2015;26:471–6.
30. Dadfar F. Effectiveness of chamomile (*Matricaria chamomilla*) extracts on the reduction of dysmenorrhea and premenstrual syndrome symptoms. *Der Pharm Lett.* 2015;7:454–8.
31. Ataollahi M, Akbari SA, Mojab F, Roshanaie G. Effects of aromatherapy by rosa-cens on the severity and systemic symptoms of primary dysmenorrhea. *Adv Nurs Midwifery.* 2015;25:59–67.
32. Chen J, Jiang Q-D, Wu Y-M, et al. Potential of essential oils as penetration enhancers for transdermal administration of ibuprofen to treat dysmenorrhoea. *Molecules.* 2015;20:18219–36.
33. Salehian T, Safdari DF. The effect of aromatherapy abdominal massage on alleviating primary dysmenorrhea in students. *Iran J Nurs Res.* 2015;9:29–35.
34. Bakhshshirin F, Abedi S, YusefiZoj P, Razmjooee D. The effect of aromatherapy massage with lavender oil on severity of primary dysmenorrhea in Arsanjan students. *Iran J Nurs Midwifery Res.* 2015;20:156–60.
35. Beiravand S, Hosseinabadi R, Anbari K, Beiranvand SP, Asti P. The effect of lavender aromatherapy massage on severity and symptoms of primary dysmenorrhea. *Complement Med J.* 2015;1:1028–41.
36. Wong J, Chiang Y-F, Shih Y-H, et al. *Salvia sclarea* L. essential oil extract and its antioxidative phytochemical sclareol inhibit oxytocin-induced uterine hypercontraction dysmenorrhea model by inhibiting the Ca<sup>2+</sup>-MLCK-MLC20 signaling cascade: an ex vivo and in vivo study. *Antioxidants.* 2020;9:1–16.
37. Masoudi N, Niktabe Z, Tabarrai M, Nejatbakhsh F, Masoudi A. Efficacy of *Saussurea costus* (Qost) oil as an iranian traditional medicine product on primary dysmenorrhea: case series. *Tradit Integr Med.* 2020;5:118–25.
38. Ni H, Liu J, Dai O, et al. Chemical composition and uterine smooth muscle relaxant activity of essential oils from 10 kinds of blood-activating and stasis-resolving chinese medicinal herbs. *J Ethnopharmacol.* 2021:269.
39. Bi W, Zhou J, Zhao L, et al. Preventive effect of different citrus essential oils on primary dysmenorrhea: in vivo and in vitro study. *Food Biosci.* 2021:42.
40. Yunianingrum E, Widyastuti Y, Margono. The Effect of Warm Compress and Aromatherapy Lavender to Decreasing Pain on Primary Dysmenorea. *J Kesehatan Ibu dan Anak.* 2018;12:39–47.
41. Shirooye P, Hashem-Dabaghian F, Hamzeloo-Moghadam M, et al. A clinical comparative study of oral and topical ginger on severity and duration of primary dysmenorrhea. *Res J Pharmacogn.* 2017;4:23–32.
42. Uysal M, Doğru HY, Sapmaz E, et al. Investigating the effect of rose essential oil in patients with primary dysmenorrhea. *Complement Ther Clin Pract.* 2016;24:45–9.
43. Perkins A. Have you considered aromatherapy? *Nurs Made Incred Easy!*. 2020;18:20–4.