



Systematic review Article

A Systematic Review on the Anxiolytic Effect of Aromatherapy during the First Stage of Labor

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ABSTRACT

Introduction: Anxiety is the most common psychological response of women to labor. The aim of the present systematic review was to evaluate and summarize the available clinical evidence on the anxiolytic effects of aromatherapy during the first stage of labor.**Methods:** Electronic databases including: Cochrane Library, MEDLINE/ PubMed, Scopus, CINAHL, SID, Iran Doc, ProQuest, and Google Scholar were searched up to Sep10, 2017 with the keywords of 'aroma*', 'aromatherapy', 'essential oil', 'anxiety', and 'labor'. The risk of bias in the included studies was assessed using the Cochrane Collaboration's 'Risk of bias' tool. The results were reported qualitatively.**Results:** A total of 14 published papers and 2 unpublished papers were retrieved which met the inclusion criteria.

The studies were conducted in Iran, Egypt, Korea, and Italy. Essential oils had been used were lavender in 5 articles, rose, clary sage, geranium and frankincense in 3 articles, chamomile, bitter orange, sweet orange and peppermint in 2 articles, mandarin orange, jasmine and clove in 1 article. A majority of the studies suggested a positive effect of aromatherapy in reducing women's anxiety during the first stage of labor.

Conclusion: It is recommended that aromatherapy could be applied as a complementary therapy for reducing anxiety during the first stage of labor, but methodologically rigorous studies should be conducted in this area.**Citation:** Ghiasi A, Bagheri L, Haseli A. A systematic review on the anxiolytic effect of aromatherapy during the first stage of labor. J of Caring Sci 2019; 8 (1): 51-60. doi:10.15171/jcs.2019.008

Introduction

Anxiety is the most common psychological response of women to labor.¹ According to the control theory, there is a relationship between pain and psychological problems like anxiety.² Maternal anxiety during labor leads to severe contraction of the pelvic floor and perineal muscles and this can increase the labor pain.³ Another effect of anxiety is its effect on labor progression. Anxiety during labor activates the sympathetic nervous system and expands hormonal secretion such as adrenaline, noradrenaline, and cortisol, which can lead to decreased effective uterine contractions, prolonged first and second stages of labor, increased invasive interventions, and even increased likelihood of cesarean delivery.⁴ There are numerous pharmacological and non-pharmacological interventions for reducing anxiety.⁵ In recent years, non-pharmacological methods such as relaxation techniques, reflexology, massage therapy, and listening to music have found a special place in midwifery science because of their availability, cost effectiveness, low complications, and easy usage.⁶ Aromatherapy is one of the non-pharmacological methods which use essential or volatile oils extracted from aromatic plants to treat or prevent several diseases.⁷ Two basic mechanisms are offered to explain the purported effects of this therapy. One is the influence of aroma on the brain; especially the limbic system through the olfactory system and the other is the direct pharmacological effects of the essential oils.^{8,9}

Although several systematic review studies have been conducted on the effectiveness of aromatherapy in

reducing pain during labor, there is no review of this therapy on women's anxiety during labor.^{10,11} Hence, this systematic review study aimed to summarize the clinical trial intervention studies that evaluated the effect of aromatherapy on women's anxiety during the first stage of labor.

Materials and methods

The study was approved by the Ethics Committee of Shahrood University of Medical Sciences with the ethical code: IR.SHMU.REC.1396.25.

2.1. Literature Search Strategy

The following databases were searched between 18 August and 10 September 2017 to identify eligible articles: Cochrane Library, MEDLINE/ PubMed, Scopus, CINAHL, and Persian Scientific Information Database (SID). The search was limited to the English and Persian languages. We also searched for dissertations and theses, using the Irandoc (Irandoc.ac.ir) and proQuest databases. The following terms or a combination of them were used for searching in English databases: 'aroma*', 'aromatherapy', 'essential oil', 'anxiety', and 'labor'. Persian terms equivalent to the English terms mentioned above were used for searching in Persian electronic databases. To ensure that no article was missed, we also searched Google Scholar, using both Persian and English search terms. In a final search, the reference lists of the included articles were also hand-searched to identify further relevant articles.

2.2. Eligibility Criteria

Studies met the inclusion criteria if they assessed the effects of aromatherapy essential oils on women's anxiety during the first stage of labor. If the full text of an article could not be obtained, we included its abstract only when it had sufficient data.

2.3. Study Selection

The bibliographic records obtained from the search were imported into Endnote X7 and duplicates were removed. Then, two independent reviewers screened and selected articles based on the title, subsequently on abstract and finally on full text. Disagreements were resolved via discussion with a third reviewer.

2.4. Data Extraction

The following information was extracted from the studies that met the eligibility criteria: 1) first the author's name and year of publication; 2) participant characteristics (country of origin, sample size and mean age); 3) study characteristics (methods of participant allocation, allocation concealment, blinding, drop-out rates and reasons for drop-outs); 4) nature of aromatherapy intervention (type, dose, duration, route of administration for experimental and control interventions); 5) outcomes (instrument used to assess anxiety and outcome data).

2.5. Quality Assessment

The risk of bias of the included studies was assessed independently by two reviewers using the Cochrane Collaboration's 'Risk of bias' tool.¹² The criteria consisted of selection bias (random sequence generation and allocation concealment), performance bias (blinding of participants and personnel), detection bias (blinding of outcome assessment), attrition bias (incomplete outcome data), and reporting bias (selective outcome reporting). Each item was classified as 'low risk of bias', 'high risk of bias', or 'unclear risk of bias'. Disagreements were resolved by discussion between two reviewers.

Results

3.1. Description of the included studies

3.1.1. Literature Search

On the initial search, 1415 articles were retrieved. After excluding 494 duplicates and 900 irrelevant articles, 21 articles remained for further full text screening. A total number of 5 studies were excluded at this stage, 2 studies were duplicate publications, 2 studies contained overlapping data, and 1 study was not original literature. Eventually, 16 studies¹³⁻²⁸ were verified to meet our inclusion criteria. Two studies^{13,14} were master's theses and 14 were published in peer-reviewed journals. The full text of one study¹⁵ could not be retrieved and the relevant data were extracted from its abstract. The findings of one study were presented in three separate reports.¹⁷⁻¹⁹ The systematic study selection is presented in the form of a flow diagram (Figure 1).

3.1.2. Study Characteristics

All the included studies were published between 2003 and 2016. The studies were conducted in Iran (12),^{13,14,16-25} Korea (2),^{15,26} Egypt (1),²⁷ and Italy (1).²⁸ All the 16 trials used a parallel-group design. Thirteen studies used a 2-parallel-arm group design,^{13-23,27,28} and three used a 3-parallel-arm group design.²⁴⁻²⁶

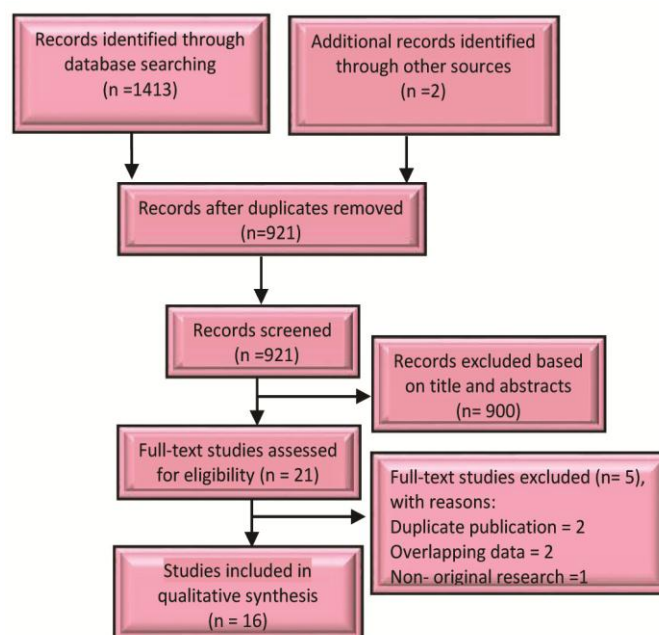


Figure 1. PRISMA flow diagram

(1) Participants

The total number of the participants in the 14 studies was 1891, whereas the number of the participants in the individual studies ranged from 48 to 513. The participants' mean age was not clearly reported in 4 trials.^{15,23,24,27} Fourteen studies included primiparous women,^{10-22,24} and two studies were not restricted by parity.^{26,28}

(2) Interventions/Comparators

The types of aromatherapy administration in the RCTs included aromatherapy inhalation,^{13,14,16-25,28} massage,^{15,26-28} footbath,²⁸ inhalation and footbath,²⁸ birthing pool,²⁸ acupressure points,²⁸ and compress.²⁸ Lavender either as a single essential oil or in a mixture with other essential oils was the most popular essential oil within the studies.^{16,24,26-28} The comparison groups in the studies included no intervention group (n= 5; received routine care in labor),^{15,24-26,28} placebo group (n = 12; received normal saline, distilled water, carrier oil, footbath, massage only or massage with inert carrier oil),^{13,14,16-18,20-22,24-27} and active control group (n=2; aromatherapy).^{19,23}

(3) Outcome Measure

In thirteen studies,^{13-24,27} the state sub-scale of State-Trait Anxiety Inventory (STAI) and in two studies^{25,26} the Visual Analogous Scale Anxiety (VASA) were used to

assess the women's anxiety. In one study,²⁸ the instruments for assessing anxiety had not been mentioned.

3.2. Risk of bias in the included studies

Random sequence generation was adequately described by description in seven trials. Six studies^{13,14,20-22,25} referred to a random number table and one study²⁸ used computer generated randomization for sequence generation. The other trials did not describe the sequence generation process. Allocation concealment was adequate in one study²⁸ whose allocation was concealed by using envelopes. The other trials were rated 'unclear', as they

did not have clear descriptions of their method of allocation concealment. All the studies included had a high risk of bias for blinding of the participants, care providers and outcome assessors. All the studies were judged to have a low risk of bias for incomplete outcome data; fifteen¹³⁻²⁵ had no participant losses, or the missing data were balanced in numbers across groups and one study²⁸ was performed an 'intention-to-treat' analysis. As far as we could see, all studies included were free of selective outcome reporting and other potential sources of bias. See Figure 2; 'Risk of bias' graph and Figure 3 'Risk of bias' summery of included studies.

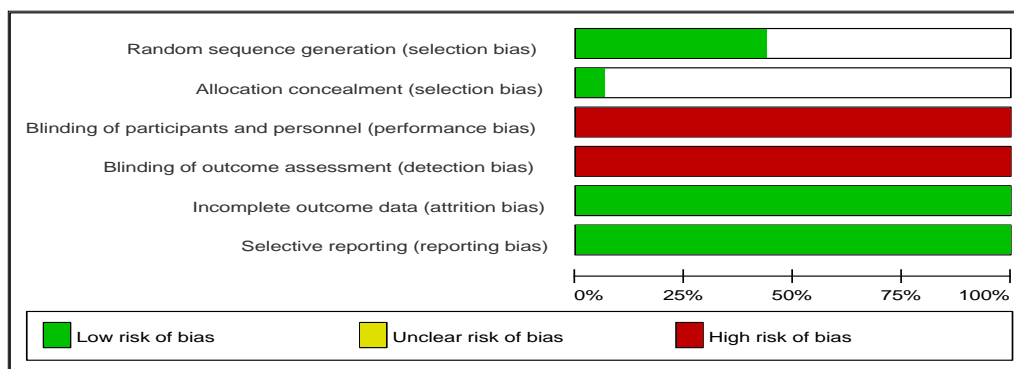


Figure 2.. Risk of bias' graph across all included studies

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)
Burns E et al., 2007	Green	Yellow	Red	Red	Green	Green
Esmaelzadeh Saeieh S et al., 2016	Green	Yellow	Red	Red	Green	Green
Hamdamian S et al., 2014	Green	Yellow	Red	Red	Green	Green
Heidari Fard S et al., 2015	Green	Yellow	Red	Red	Green	Green
Hur MH and Park MH., 2003	Green	Yellow	Red	Red	Green	Green
Kheirkhah M et al., 2012	Green	Yellow	Red	Red	Green	Green
Kyoung LM & Haeng HM., 2011	Green	Yellow	Red	Red	Green	Green
Lamadah SM & Nomani I., 2016	Green	Yellow	Red	Red	Green	Green
Mirzaei F et al., 2009	Green	Yellow	Red	Red	Green	Green
Namazi M et al., 2014	Green	Yellow	Red	Red	Green	Green
Ozgoli et al., 2013	Green	Yellow	Red	Red	Green	Green
Ozgoli et al., 2016	Green	Yellow	Red	Red	Green	Green
Rashidi-Fakari F et al., 2015	Green	Yellow	Red	Red	Green	Green
Rashidi-Fakari F et al., 2015	Green	Yellow	Red	Red	Green	Green
Rashidi-Fakari F et al., 2015	Green	Yellow	Red	Red	Green	Green
Tafazoli M et al., 2010	Green	Yellow	Red	Red	Green	Green

Figure 3. 'Risk of bias' summery across all included studies

The detailed information of the included studies has been shown in Table 1.

3.3. Efficacy of Essential Oils

(1) Lavender: Lavender (*Lavandula officinalis*) which belongs to the family of Lamiaceae, is a plant that is widely used in aromatherapy. It contains camphor, terpinen-4-ol, linalool, linalyl acetate, beta-ocimene and 1, 8-cineole. The studies on the benefits of lavender's aroma have shown that linalool and linalyl acetate present in this plant can stimulate parasympathetic system. In addition, linalyl acetate has narcotic effects and linalool acts as a sedative.⁸ The effect of lavender essential oil on anxiety during the first stage of labor had been examined in five studies. Lavender aromatherapy via inhalation was used in the two studies.^{16,24} Mirzaei *et al.*, reported that the anxiety level in the lavender inhalation group was significantly lower than that of the control group 60 minutes after the intervention.¹⁶ In Tafazoli *et al.*, study, the anxiety level of intervention group was significantly lower than that of the other two groups immediately and 60 minutes after lavender inhalation.²⁴ Aromatherapy massage with lavender essential oil had been used in two studies.^{26,27} Lavender was used as a single essential oil in the Lamadah and Nomani study and was blended with some other essential oils in the Kyoung and Haeng study.

Aromatherapy massage was conducted by the researchers in Lamadah and Nomani study and it was conducted by the spouses in Kyoung and Haeng study. In Lamadah and Nomani study, the anxiety score was significantly lower in the aromatherapy back massage group than in the only-back massage group.²⁷ In Kyoung and Haeng study, a mixture of four essential oils was used, one of which was lavender essential oil. In that study, the anxiety level was significantly decreased only at 8-10 cm cervical dilatation in the spouse's aromatherapy massage group compared with the spouse's carrier oil massage group and the control group.²⁶ In a study by Burns *et al.*, a choice of five essential oils (Roman chamomile, clary sage, frankincense, lavender, and mandarin) was offered to women who were allocated to the intervention group. Lavender essential oil was the most favorite essential oil that was used during the first stage of the labor. In that study, aromatherapy was conducted using one of the following ways: acupressure, taper, compress, footbath, massage or birthing pool. The results of this study indicated that aromatherapy significantly reduced women's anxiety.²⁸

(2) Rosa: Roses are perennial shrubs or vines which belong to the genus *Rosa*, within the family Rosaceae. *Rosa damascena* commonly known as Damask rose is one of the most important species of Rosaceae family.²⁹ It is grown in some parts of Europe and Asia particularly in the Middle East.³⁰ The materials sytrinol and 2-phenyl ethyl alcohol, in roses are known as anti-anxiety agents.²⁵

In a study conducted by Hur and Park, the experimental group received an aromatherapy massage with essential oils of *rosa damascena*, clary sage, geranium, and jasmine. The control group only received the routine labor care. The study results revealed that the anxiety level was not significantly different between the two groups.¹⁵ In the Kheirkhah *et al.*, study, one group received inhalation and footbath aromatherapy with rose

essential oil while another group received only warm-water footbath, and they were compared to the control group. The findings showed that both interventions had a significant effect on lowering the anxiety level of women during the active phase of the labor.²⁵ The study of Hamdamian *et al.*, indicated that subjects who received inhalation aromatherapy with *rosa damascena* essential oil had a significant reduction of anxiety level when compared with those in the placebo group.¹³

(3) Clary sage: Clary sage (*Salvia sclarea*) belongs to the Lamiaceae family and is a biennial or perennial tap-rooted plant native to the ancient mediterranean region. Clary sage is different from common sage (*Salvia officinalis*). It contains mainly linalool, linalyl acetate, alpha-terpineol, germacrene D, and geranyl.³¹

In a study by Hur and Park, essential oils of clary sage, rose, geranium and jasmine were used during the active phase of labor. The study results showed that there was no significant difference in the mean anxiety score between the aromatherapy and control groups after the intervention.¹⁵ In Kyoung and Haeng study, clary sage was used along with citrus aurantium, frankincense, and lavender. The findings showed that the level of anxiety was significantly decreased only at 8-10 cm cervical dilatation in the spouse's aromatherapy massage group compared to the other two groups.²⁶ In a study by Burns *et al.*, 28 out of 251 women in the intervention group selected clary sage oil for aromatherapy during the active phase of labor. The results showed that the anxiety level was significantly lower in the experimental group than they were in the control group.²⁸

(4) Geranium: Geranium (*Pelargonium graveolens*) belongs to the family Geraniaceae. Geranium essential oil has anti-inflammatory, anti-depressant, sedative, anxiety-reducing, and muscle-relaxing properties.¹⁷

In a study conducted by Hur and Park, aromatherapy massage using geranium, rose, clary sage and jasmine was given to the experimental group. The control group received only routine care during labor. The results showed there was no significant difference in the anxiety level between the two groups after the intervention.¹⁵ In the study by Rashidi-Fakari *et al.*, the experimental group inhaled geranium essential oil and the placebo group inhaled distilled water. A significant reduction was observed in the level of anxiety in both groups 20 minutes after the interventions. However, the reduction was more in the aromatherapy group in comparison to the placebo group.¹⁷ In another article by Rashidi-Fakari and Tabatabaeichehr, the anti-anxiety effect of geranium essential oil was compared with orange peel essential oil during the first stage of labor. In this study, the level of anxiety in both geranium and orange peel groups was reduced 20 minutes after the interventions. However, the reduction was more in the geranium group in comparison to the orange peel group.¹⁹

(5) Frankincense: Frankincense essential oil is extracted from the resin of *Boswellia* trees and used to reduce stress and anxiety, pain and inflammation, to boost immunity and even fight cancer.³²

The study by Esmaelzadeh *et al.*, showed that subjects who received inhalation aromatherapy with frankincense essential oil had a significant decrease in the anxiety level when compared with the placebo group.²⁰ Frankincense was one of the five essential oils that was used in the

study by Burns et al. The results showed that aromatherapy group had significantly reduced the anxiety level compared to the control group.²⁸ In a study conducted by Kyoung and Haeng, a blend of frankincense with three other essential oils was used for aromatherapy during the first stage of labor. In this study, the anxiety level was significantly reduced only at 8-10 cm cervical dilatation in the aromatherapy group compared to the other two groups.²⁶

(6) Chamomile: There are different species of chamomile, the two most commonly used ones being German Chamomile (*Matricaria recutita*) and Roman Chamomile (*Chamaemelum nobile*), both of which are members of the Asteraceae/Compositae family. Chamomile essential oil is employed for its anxiolytic properties.³³

The effect of aromatherapy with chamomile essential oil on women's anxiety during the first stage of labor was evaluated in two studies. In a study by Burns et al.,¹⁸ out of 251 women in the intervention group selected roman chamomile essential oil for aromatherapy. This study indicated that women who received aromatherapy had significantly reduced the anxiety level compared to the control group.²⁸ In a study by Heidari Fard et al., there was a significant difference in the anxiety score between women who were allocated to the inhalation Aromatherapy via German chamomile group and the control group.¹⁴

(7) Bitter orange: The Bitter orange (*Citrus aurantium*) is a plant belonging to the Rutaceae Family. Essential oils of *C. aurantium* stimulates the central nervous system and has sedative, analgesic, anti-inflammatory, antispasmodic, antidepressant, carminative, digestive, and diuretic properties.²²

In a study conducted by Kyoung and Haeng, spouse's aromatherapy massage using citrus aurantium, lavender, clary sage, and frankincense was given to the experimental group. In this study, the level of anxiety in the experimental group was significantly decreased only at 8-10 cm cervical dilatation compared to the other two groups.²⁶ The study of Namazi et al., indicated that the participants who received inhalation aromatherapy using citrus aurantium essential oil had a significant reduction of anxiety level when compared with the participants who had not received it.²²

(8) Sweet orange: Sweet orange (*Citrus sinensis*) is a member of the Rutaceae family.³⁴ The main chemical component of peel essential oil of sweet orange is Limonene. Studies have shown that orange scent is a suitable aroma to decrease anxiety.³⁵

In the study by Rashidi-Fakari et al., the experimental group inhaled orange essential oil and the placebo group inhaled distilled water. The results showed that the anxiety level of women in both aromatherapy group and the placebo group was significantly decreased 20 minutes after the interventions. However, the reduction was more in the aromatherapy group in comparison to the placebo group.¹⁸ In another article by Rashidi-Fakari and Tabatabaeichehr, anti-anxiety effect of orange peel essential oil was compared with geranium essential oil. In this study, the level of anxiety of women in both geranium and orange peel groups was reduced 20 minutes after the interventions. However, the reduction was more in the geranium group in comparison with the orange peel group.¹⁹

(9) Peppermint: Peppermint (*Mentha piperita*), belongs to the Lamiaceae family and is a fragrant, easy-growing plant. Peppermint oil has been studied and documented for its anti-inflammatory, analgesic, anti-infectious, antimicrobial, antiseptic, antispasmodic, astringent, digestive, carminative, fungicidal effects, nervine stimulant, vasoconstrictor, decongestant and stomachic properties.⁸

In the study by Ozgoli et al., subjects who received inhalation aromatherapy using peppermint essential oil only at 8-10 cm cervical dilation had a significantly lower anxiety level compared with the placebo group.²¹ Another study by Ozgoli et al., showed clove aromatherapy in comparison with peppermint aromatherapy was more effective in reducing anxiety during the first stage of labor.²³

(10) Mandarin orange: Mandarin orange (*Citrus reticulata*) is a tropical and sub-tropical tree belonging to the Rutaceae family. Mandarin essential oil has antiseptic, antispasmodic, circulatory, cytophylactic, depurative, digestive, hepatic, nervous relaxant and sedative properties.³⁶

Mandarin orange was one of the five essential oils that was used in the study by Burns et al., the results showed that the anxiety score was significantly lower in the aromatherapy group compared to the control group.²⁸

(11) Jasmine: Jasmine (*Jasminum officinale*) is a member of Oleaceae family. The therapeutic properties of jasmine essential oil are anti-depressant, antiseptic, sedative and anti-inflammatory.³⁷

In a study conducted by Hur and Park, aromatherapy massage using jasmine, clary sage, geranium, and rosa damascena was given to the experimental group. This study showed no significant difference in the anxiety level between aromatherapy massage group and the control group.¹⁵

(12) Clove: Clove (*Eugenia Aromatica*) belongs to the family Myrtaceae. The therapeutic properties of clove oil are analgesic, antiseptic, antispasmodic, anti-neuralgic, anti-infectious, insecticide, stomachic, uterine and tonic.³⁸ In a study by Ozgoli et al., anxiolytic effect of clove essential oil was compared with peppermint essential oil. In this study, the anxiety was reduced in both groups after the interventions. However, clove aromatherapy was significantly more effective than peppermint aromatherapy for reducing anxiety during the first stage of labor.²³

Discussion

To our knowledge, this is the first systematic review study to assess the effect of aromatherapy on anxiety during the first stage of labor. We included 16 trials, most of them were conducted in Iran. The methodological quality of the included studies was assessed using the Cochrane 'risk of bias' tool. Only in 7 trials had the methods of randomization been described and only 1 study had stated the method of allocation concealment.

Due to high heterogeneity of the studies (different aroma-types, different dosages of essential oil, different ways to use essential oils, different duration of aromatherapy, different control groups, different assessment tools) a meta-analysis was not performed. Therefore the results were reported qualitatively.

Table 1. Characteristics of included studies

Author- year	Type of study	Country	Number of participants	Mean age (I/C) (SD)	Interventions & comparisons	Assessment	Analysis (I/C)	Outcomes
Mirzaei F et al. 2009[16]	RCT	Iran	121 Primiparous women	23 (4) / 23 (4)	Group 1 inhaled Cotton clothes impregnated with 0.2 ml of lavender essential oil and 2 ml distilled water which were attached to their gown at 3-4 cm cervical dilation for 1 hour Group 2 received just 2ml of distilled water via the same way	Anxiety assessed by STAI before and 60 min after the intervention	63 / 58	There was a significant difference in levels of anxiety between the two groups at 60 min after the intervention (P<0.001)
Tafazoli M et al. 2010[24]	RCT	Iran	102 Primiparous women	NA	Group 1 inhaled napkins impregnated with 1 drop lavender essential oil which were attached to their clothes for 15-min. Group 2 received 1drop sweet almond oil via the same way. Both interventions were applied at 3-5 cm cervical dilation. Group 3 received routine care in labor	Anxiety assessed by STAI before the intervention, immediately and 60 min after the intervention	34 / 34 / 34	There was a significant difference in mean anxiety score between the two groups immediately (P=0.001) and 60 min (P=0.001) after the intervention
Lamadah SM and Nomani I . 2016[27]	RCT	Egypt	60 Primiparous women	NA	Group 1 received aromatherapy back massage with 2 drops of lavender essential oil diluted in 50cc almond oil one time at 5-7 cm and another time at 8-10 cm cervical dilation for 20 minutes every time Group 2 received only back massage	Anxiety assessed by STAI before the intervention at latent phase and after the intervention at 5-7 cm and 8-10 cm of cervical dilation	30 / 30	There was a significant difference in mean anxiety score between the two groups after the intervention at 5-7 cm (P= 0.05) and 8-10 cm (P= 0.03) cervical dilation
Hur MH and Park MH. 2003[15]	RCT Pretest -post test	Korea	48 Primiparous women	NA	Group1 received aromatherapy back massage with aromatherapy oil (1.5% dilution essential oil of clary sage, geranium, jasmine, and rose (4: 4: 1: 1 ratio)) for 10-min every two hours in active phase. Group2 received routine care in labor	Anxiety assessed by STAI at latent, active and deceleration phases	24 / 24	There was no significant difference in levels of anxiety between the two groups after the intervention (P>0.05)
Burns E et al. 2007[28]	RCT	Italy	513 Primiparous / Multiparous women	31.6 (4.3) / 31.6 (4.5)	Group 1 received 1 of 5 essential oil: lavender (112 women), mandarin (62 women), clary sage (28 women), frankincense (26 women) and Roman chamomile (18 women). The aromatherapy was applied using taper (99 women), massage (85 women), birthing pool (51women), acupressure points (14 women), compress (2 women) and footbath (11 women). Group 2 received routine care in labor	Information about anxiety was gathered in a short questionnaire	251 / 262	Level of anxiety after the intervention was significantly lower in the intervention group compared with the control group.

Table 1 (continued): Characteristics of included studies

Author- year	Type of study	Country	Number of participants	Mean age (I/C) (SD)	Interventions & comparisons	Assessment	Analysis (I/C)	Outcomes
Kyoung LM and Haeng HM. 2011[26]	RCT	Korea	81 Primiparous/ Multiparous women	30.5 (4.6) / 30.5 (3.7) / 30.2 (4.9)	Group1 received spouse's aromatherapy massage with aromatherapy oil (3% oil mixture containing Lavender, Clary sage, Citrus aurantium and frankincense (6 : 4 : 1 : 1 ratio) in sweet almond oil) Group2 received spouse's carrier oil massage Both interventions were applied for 10-min every hour after the cervix dilated 5cm Control group were with their spouse during labor	Anxiety assessed by VASA at latent phase and after the intervention at 4-7cm and 8-10 of cervical dilation	25 / 20 / 26	There was a significant difference in mean anxiety score among three groups at deceleration phase (P= 0.034). Anxiety score at deceleration phase in first group (6.0±2.4) was lower than second group (6.6±1.6) and control group (7.5±2.0).
Kheirkhah M et al. 2012[25]	RCT	Iran	120 Primiparous women	23.08 (3.2) / 23.75 (3) / 22.11 (3.1)	Group 1 received inhalation and footbath with 1% Rosa damascene essential oil for 10 minutes Group 2 placed their feet in footbath containing 40°C water for 10 minutes Both interventions were applied at the onset of active (cervical dilatation 4 cm) and deceleration (cervical dilatation 8 cm) phases Group 3 received routine care in labor	Anxiety assessed by VASA immediately before and after the intervention at onset of active and deceleration phases.	36 / 36 / 36	Level of anxiety after the intervention at onset of active phase (P<0.001), before and after the intervention at onset of deceleration phase (P<0.001) was significantly lower in the intervention groups compared with the control group.
Hamdamian S et al. 2014[13]	RCT	Iran	110 Primiparous women	25.8 (8.17) / 26.24 (5.15)	Group 1 inhaled gauzes impregnated with 0.08ml Rosa damascene essential oil which were attached to their collars from 3- 4 cm cervical dilation. Dosage was repeated every 30 min Group 2 received just 0.08ml of normal saline via the same way	Anxiety assessed by STAI at 4-5 cm and 8-10 cm of cervical dilation	55 / 55	There was a significant difference in mean anxiety score between the two groups at 4-5 cm (P= 0.000) and 8-10 cm (P= 0.000) cervical dilation
Heidari Fard S et al. 2015[14]	RCT	Iran	130 Primiparous women	25.58 (6.18) / 26.86 (5.82)	Group 1 inhaled gauzes impregnated with 2 drops of matricaria chamomilla which were attached to their clothes from 3- 4 cm cervical dilation. gauzes were changed every 30 min Group 2 received just 2 drops of distilled water via the same way	Anxiety assessed by STAI before and after the intervention at 3- 4 cm and 8-10 cm of cervical dilation	64 / 63	There was a significant difference in mean anxiety score between the two groups at 3-4 cm (P <0.0005) and 8-10 cm (P=0.0006) cervical dilation
Rashidi-Fakari F et al. 2015[17]	RCT	Iran	100 Primiparous women	23 (7) / 21 (5)	Group 1 inhaled napkins impregnated with 2 drops of 2% concentrated geranium essential oil which were attached to their collars at 3-5 cm cervical dilation Group 2 received just 2 drops of distilled water via the same way.	Anxiety assessed by STAI before and 20 min after the intervention	49 / 48	Level of anxiety of women in both intervention (P = 0.001) and control (P = 0.003) groups reduced after the intervention. However, the reduction was more in the intervention group (score = -4.02) in comparison to the control group (score = -1.14).

Table 1 (continued): Characteristics of included studies

Author- year	Type of study	Country	Number of participants	Mean age (I/C) (SD)	Interventions & comparisons	Assessment	Analysis (I/C)	Outcomes
Rashidi-Fakari F et al. 2015[18]	RCT	Iran	100 Primiparous women	20 (5) /21 (5)	Group 1 inhaled napkins impregnated with 2 drops of 2% orange peel essential oil which were attached to their collars at 3-5 cm cervical dilation Group 2 received just 2 drops of distilled water via the same way	Anxiety assessed by STAI before intervention and 20 min after the intervention	48 / 48	Level of anxiety of women in both intervention (P = 0.03) and control (P = 0.003) groups reduced after the intervention. However, the reduction was more in the intervention group (score = -3.08) in comparison to the control group (score = -1.14).
Rashidi-Fakari F and Tabatabaeicheh r M. 2015[19]	RCT	Iran	100 Primiparous women	23.5 (4.4) / 21.72 (3.3)	Group 1 inhaled napkins impregnated with 2 drops of 2% concentrated geranium essential oil which were attached to their clothes at 3-5 cm cervical dilation Group 2 received 2 drops of 2% orange peel essential oil via the same way.	Anxiety assessed by STAI before and 20 min after the intervention	49 / 48	Level of anxiety of women in both geranium (P = 0.001) and orange peel (P = 0.03) groups reduced after the intervention. However, the reduction was more in the geranium group (score = -4.02) in comparison to the orange peel group (score = -3.08).
Esmaelzadeh Saeieh S et al. 2016[20]	RCT	Iran	126 Primiparous women	22.7 (0.71) / 22.5 (0.5)	Group 1 inhaled gauzes impregnated with 0.2 ml of frankincense essential oil and 2 ml normal saline which were attached to their collars from 3-4 cm cervical dilation. cloths were changed every 30 min Group 2 received just 2ml of normal saline via the same way	Anxiety assessed by STAI at baseline and after the intervention at 3-4 cm and 8-10 cm of cervical dilation	62 / 62	There was a significant difference in mean anxiety score between the two groups after the intervention at 3-4 cm (P=0.002) and 8-10 cm (P=0.014) cervical dilation.
Ozgoli et al. 2013[21]	RCT	Iran	128 Primiparous women	24.77 (4.28) / 24.11 (3.6)	Group 1 inhaled gauzes impregnated with 0.2 ml of Peppermint essential oil and 2 ml distilled water which were attached to their collars from 3-4 cm cervical dilation. cloths were changed every 30 min Group 2 received just 2ml of normal saline via the same way	anxiety assessed by STAI before and after the intervention at 3-4 cm and 8-10cm of cervical dilation	64 / 64	There was a significant difference in mean anxiety score between the two groups after the intervention at 8-10 cm (P <0.001) cervical dilation.
Namazi M et al. 2014[22]	RCT	Iran	126 Primiparous women	26.43 (3.2) / 26.6 (3.4)	Group 1 inhaled gauzes impregnated with 4ml of Citrus aurantium essential oil which were attached to their collars from 3-4 cm cervical dilation. cloths were changed every 30 min Group 2 received 4ml normal saline via the same way	anxiety assessed by STAI at baseline and after the intervention at 3-4 and 6-8 cm of cervical dilation	57 / 56	Level of anxiety after intervention at dilations of 3-4 cm (P<0.001) and 6-8 cm (P<0.001) was significantly lower in the intervention group compared with the control group.
Ozgoli et al. 2016[23]	RCT	Iran	126 Primiparous women	NA	Group 1 inhaled gauzes impregnated with 0.2 ml of Peppermint essential oil which were attached to their collars from 3-4 cm cervical dilation. clothes were changed every 30 min Group 2 received 0.2 ml of Clove essential oil via the same way	anxiety assessed by STAI before and after the intervention at 3-4 cm and 8-10cm of cervical dilation	63 / 63	There was a significant difference in mean anxiety score between the two groups after the intervention at 3-4 cm (P=0.000) and 8-10 cm (P = 0.03) cervical dilation.

Appendix. (I/C): interventions / comparison, STAI: spiel Berger state-trait anxiety inventory, VASA: Visual analogue scale for anxiety

Essential oils that had been used in the included studies were lavender, rose, clary sage, geranium, frankincense, chamomile, bitter orange, sweet orange, peppermint, mandarin orange, jasmine, and clove. As to the administration of aromatherapy, twelve studies employed inhalation aromatherapy and four studies used the method of massage. Other modalities such as footbath, inhalation and footbath, birthing pool, acupressure points and compressor were mentioned in one study. Our review revealed a positive effect of aromatherapy in reducing anxiety during the first stage of labor. Only one study conducted in Korea suggested that massage aromatherapy with a mixture of rose, clary sage, geranium, and jasmine essential oils, in contrast to routine labor care, did not significantly reduce women's anxiety during the labor.

This study had some limitations. Although we have tried to collect the most relevant data for our study, focusing only on the published English and Persian articles was one limitation of the study which could affect the results. Of 16 included trials, only one trial had a relatively large sample size. The low methodological quality and the high heterogeneity of the included articles mean that our findings must be interpreted with caution.

Conclusion

As generally most of the reviewed studies showed a positive effect of aromatherapy on anxiety level during the first stage of labor, it is recommended that aromatherapy might help as a complementary therapy in reducing the anxiety level of women during labor, but to provide further evidence for advocating aromatherapy as an effective complementary medicine to reduce anxiety during labor, studies with stricter and more rigorous procedures in 'randomization', 'allocation concealment' and 'blinding' should be implemented. Furthermore, it is important to determine the best modalities of aromatherapy in future studies.

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Ethical issues

None to be declared.

Conflict of interest

The authors declare no conflict of interest in this study.

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