

# The effectiveness of roll-on aromatherapy of calamansi orange peel essential oil (*Citrofortunella microcarpa*) on reducing anxiety and pain in labor



Yetti Purnama<sup>1\*</sup>, Kurnia Dewiani<sup>1</sup>, Suci Rahmawati<sup>2</sup>, Linda Yusanti<sup>1</sup>, Linda Yulyani<sup>1</sup>

## ABSTRACT

**Purpose:** To determine the effectiveness of calamansi orange peel aromatherapy in reducing pain and anxiety in the active first stage of labor.

**Patients and methods:** This research is a quasi-experimental pre-posttest control group design. The number of samples was 60 people, 30 mothers for each intervention and control group. Samples were obtained by accidental sampling from 10 independent Privat Midwifery Clinics in Bengkulu and divided into 2 groups randomly. Pain level was assessed by VAS, and anxiety level was measured by HARS. Data were collected before the intervention (pre-test and after the intervention (post-test) 1 (dilatation 4), post-test 2 (dilatation 7-8 cm), and post-test 3 (dilatation 9-10). Meanwhile, the level of anxiety was only measured 2 times during the pre-test and post-test (dilatation 4). The results were analyzed using the Wilcoxon signed rank test and the Mann-Whitney U test.

**Results:** The results showed that in the intervention group, it was known that there was an effect of giving calamansi orange peel aromatherapy on pain (0.001) and anxiety (0.001) in mothers in the active phase of the first stage of labor. In the control group given orange aromatherapy, the results also showed an effect on pain (0.005) and anxiety (0.046). The results of the Mann-Whitney U test showed that there was a significant difference between the intervention and control groups in post-test 1 (0.000) and post-test 2 (0.004), but there was no significant difference in post-test 3 (0.121). Meanwhile, for the level of anxiety, it is known that there is a difference between the intervention and control groups (0.042).

**Conclusion:** Using aromatherapy of calamansi orange peel essential oil as a complementary therapy effectively reduces the level of pain and anxiety in mothers during the active phase of the first stage of labor.

**Keywords:** Anxiety, Aromatherapy, Calamansi, Experiment, Labor, Pain.

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<sup>1</sup>Department of Midwifery, Faculty of Mathematics and Natural Sciences, Universitas Bengkulu, Indonesia;

<sup>2</sup>Department of Pharmacy, Faculty of Mathematics and Natural Sciences, Universitas Bengkulu, Indonesia;

\*Corresponding author:

Yetti Purnama;  
Department of Midwifery, Faculty of Mathematics and Natural Sciences, Universitas Bengkulu, Indonesia;  
ypurnama@unib.ac.id

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## INTRODUCTION

Labor is the process of starting the uterus to contract repeatedly and causing the cervix to open and thin (dilatation) and ends with the expulsion of the products of conception in the form of the fetus, placenta, and membranes from inside the uterus in full-term pregnancy without action and complications.<sup>1</sup> Pain during labor can cause worry, tension, and anxiety in patients, causing increased secretion of adrenaline and adrenocorticotrophic hormone (ACTH), increased serum cortisol levels, and stimulated increased catecholamines which increase stimulation from the pelvis to the brain due to decreased blood flow and increased muscle tension. This

activation will increase the perception of pain. Perception of pain or pain tolerance varies depending on each individual. The pain intensity during labor may affect the mother's psychological condition, the delivery process, and the fetus.<sup>1,2</sup>

Fear and anxiety due to severe labor pain can also cause prolonged labor because stimulation of the sympathetic nervous system stimulates increased catecholamine secretion, which leads to increased levels of the hormone epinephrine, which results in weak uterine contractions so that uterine contractions are not in line with the opening of the cervix.<sup>1,3</sup> Traumatic childbirth experiences lead to longer intervals in subsequent deliveries and increase the risk of cesarean

section. The results of a case-control study by Sydsjo et al. in Southeastern Sweden in 2001-2007 in 23,000 samples showed that women who experienced fear during childbirth were 5.2 times at risk for cesarean section and severe anxiety increased labor time by 40 minutes in the active phase ( $p = <0.001$ ).<sup>4,5</sup>

One of the efforts to overcome labor pain with non-pharmacological methods is aromatherapy. Aromatherapy uses extracts or essential oils with certain fragrances to spread the aroma in the delivery room. The effect can be calming, eliminating anxiety and worry, and relaxing the birthing mother. Many aromatherapy products on the market have been proven to reduce anxiety and

labor pain, one of which is aromatherapy from orange peels. Calamansi orange peel (*Citrofortunella Microcarpa*) has a distinctive aroma and is liked by many people. The content of calamansi essential oil is almost the same as that of another citrus, such as decanal, which is often used as a fragrance and is useful for stabilizing the nervous system so that it can have a calming effect on anyone who inhales it. Decanal in aromatherapy causes a feeling of relaxation.<sup>6-8</sup>

Calamansi orange (*Citrofortunella Microcarpa*) is a commodity developed in Bengkulu Province and processed into calamansi orange syrup.<sup>9</sup> The by-products of the calamansi orange syrup industry are peels, pulp, seeds, and liquid resulting from settling.<sup>10</sup> Orange peels contain many essential oils, one of which can be used in lip balm and peel-off masks.<sup>6</sup> However, the benefits of essential oils to relieve pain in pregnant women have not been explored. Soraya's research (2021) shows that lemon-citrus aromatherapy can reduce labor pain in the first stage of the active phase.<sup>7</sup> Irmawati's research (2021) showed that there was an effect of giving bitter orange aromatherapy to labor pain in the active phase of the first stage of labor.<sup>11</sup> Sweet orange aromatherapy and bitter orange essential oil can reduce pain and anxiety in birthing mothers.<sup>12</sup> Purnama Y et al. showed that the phytochemical results of the essential oil of calamansi orange peel have the main decanal content (C<sub>12</sub>H<sub>24</sub>O).<sup>13</sup> This decanal compound is an organic compound often used as a fragrance. It is useful for stabilizing the nervous system to have a calming effect on anyone who attracts it. Decanal in aromatherapy causes a feeling of relaxation.<sup>6-8</sup> Therefore, this study aims to determine the effectiveness of giving aromatherapy essential oil of calamansi orange peel in reducing pain and anxiety in women during the active phase of the first stage of labor.

## MATERIAL AND METHODS

### Study Design

The research design used in this study was an experiment with a pre and post-test control group design. This design used two groups: the intervention group (the group that received conventional

treatment and intervention using roll-on calamansi orange peel essential oil) and the control group (the group that received conventional treatment and was given citrus aromatherapy).

### Subject

The subjects of this study were mothers in the active phase of the 1st stage of labor who were willing to be research respondents with informed consent sheets and met the inclusion criteria (in the active phase of the stage of labor, intact membranes, adequate uterine contractions, not yet induction, age 20-35 years, estimated weight fetus >2500 gr and less than 4000 gr) and do not meet the exclusion criteria (cephalopelvic disproportion, Hemoglobin <11 gr%, BMI <18.5 and ≥30, pregnancy with pre-eclampsia, antepartum bleeding, and other contraindications to vaginal delivery). Meanwhile, respondents who meet these criteria will be dropped if vaginal delivery cannot continue, precipitous labor, and prolonged labor. The respondents in this study were 60 mothers and 30 people for each intervention and control group. Respondents were taken by accidental sampling technique.

### Roll-on formulation and organoleptic test

Before the research, the Roll-on aromatherapy essential oil of calamansi orange peel had been formulated first. The type of calamansi orange peel essential oil used has also been assisted in advance by the Directorate of Scientific Collections Management, the Indonesian National Agency for Research and Innovation (BRIN). The results of identification with No. B-4314/ii.6.2/DI.05.07/11/2022 shows that the preparation sent is calamansi (*Citrus x macrocarpa* Bunge). Then a Roll-on formulation was carried out by mixing the essential oil of calamansi orange peel (2%), Vitamin E (0.2%) as an antioxidant or preservative, and sunflower oil (Ad 100) as a basic ingredient.

After the Roll-on formulation was completed, an Organoleptic Test was carried out, a test related to the respondent's response to odors. Tests were carried out on 20 respondents among female students of the Midwifery Study Program, with questions grouped into

four statements, from dislike to like. The results showed that 50% said they liked it, 40% said they liked it, and 10% said they didn't like it very much. This shows that the essential oil of calamansi orange peel is much liked by women and can be an option in using aromatherapy.

### Data Collection

Mothers in the first stage of labor who were willing to be research respondents and signed the informed consent form were randomized using the random permuted blocks technique to either the intervention group or the control group. Respondents in the intervention and control groups will have their pain and anxiety levels measured before receiving aromatherapy. Anxiety levels were measured using the Visual Analogue Scale (VAS), and anxiety levels were measured using the Hamilton Anxiety Rating Scale (HARS). After the pre-test is carried out, the mother will be asked to inhale aromatherapy from the prepared roll-on. Respondents are also welcome to apply it on their wrist and neck, on a tissue, or inhale the smell directly. Then after 20 minutes, the first post-test will be carried out (while the dilatation is still 4 cm), the second post-test will be carried out at the dilatation of 7-8 cm, and the 3rd post-test will be carried out at the dilatation of 9-10 cm. Meanwhile, the level of anxiety after the intervention was only measured at the dilatation of 4 cm.

### Data Analysis

The data that was collected was then tabulated and coded for analysis. The data were analyzed using the Wilcoxon signed rank test to see each intervention's effect in each group. Then to find out the effectiveness of roll-on aromatherapy of calamansi orange peel by comparing the intervention group and the control group, the analysis was carried out with the Mann-Whitney U test.

## RESULTS

### Respondent Characteristics

Table 1 shows that the characteristics of respondents in the intervention and control groups have almost the same characteristics. The parity of respondents in this study was the majority of multiparas (60%) in each group. The education of the

**Table 1. Characteristics Of Respondent.**

Characteristics	Intervention (n=30)		Control (n=30)	
	f	%	f	%
<b>Parity:</b>				
Multipara	18	60	18	60
Primipara	12	40	12	40
<b>Education:</b>				
low	3	10	4	13.3
Middle	15	50	16	53.4
High	12	40	10	33.3
<b>Birth weight:</b>				
2500-2999 gr	5	16.7	6	20
3000-3500 gr	22	73.3	22	73.3
3501-4000 gr	3	10	2	6.7

Note: gr, grams; n, sample

**Table 2. The Effect of Aromatherapy on Levels of Pain and Anxiety.**

Group	Pain			Anxiety		
	Mean	St. D	p-value	Mean	St. D	p-value
<b>Intervention</b>						
Pre	1.83	0.461	0.001	2.30	0.596	0.001
Post 1	1.43	0.504		1.77	0.679	
<b>Control</b>						
Pre	1.83	0.648	0.005	2.27	0.640	0.046
Post	2.23	0.679		2.13	0.681	

**Table 3. The effectiveness of Calamansi Orange Peel Essential Oil on Reducing Labor Pain and Anxiety.**

Variable	Intervention (Mean rank)	control (Mean rank)	p-value
Pain			
Post-test 1	21.62	39.38	0.000
Post-test 2	26.45	34.55	0.044
Post-test 3	27.50	33.50	0.121
Anxiety (post-test 1)	26.32	34.68	0.042

majority of respondents in each group is secondary education ( $\geq 50\%$ ). Most newborns in each group were in the range of 3000-3500 gr (73.3%).

### The Effectiveness of Roll-on Aromatherapy of Calamansi Orange peel Essential oil to reduce pain and anxiety during the first stage of labor

Table 2 is the result of the Wilcoxon signed rank test, which shows that the use of aromatherapy of calamansi orange peel reduces labor pain with a p-value of 0.001 and has an effect on reducing the level of anxiety with a p-value of 0.001. Meanwhile, in the control group, the use of citrus orange aromatherapy also reduced the level of pain and anxiety in laboring mothers with p-values of 0.005 and 0.046, respectively.

Table 3 shows the results of the Mann-Whitney U test in post-test 1 showed that there was a significant difference (p-value 0.000) between the intervention and control groups. In post-test 2, it showed that there was a difference in pain levels, although not too significant (p-value 0.044). Meanwhile, in post-test 3, it was known that the results of the Mann-Whitney U test showed no significant difference in pain levels between the intervention and control group (p-value = 0.121). Meanwhile, the results of the analysis of the level of anxiety also show that there is a difference (p-value = 0.042). However, if seen from the Mean Rank of the two groups, it is known that the mean rank of the intervention group is lower than the control group.

## DISCUSSION

Most respondents in each group were multiparas (60%), meaning that the respondents had previously given birth vaginally. Mothers who have previous experience have experienced the feeling of labor pain and how to deal with it.<sup>14</sup> This can affect the mother's perception of labor pain. Primiparous mothers usually show a higher level of anxiety because they have never had previous experience. This is related to increased anxiety and doubts about anticipating pain during labor.<sup>15</sup>

Most respondents' education was in secondary education in both the intervention group and the control group. According to Hwari (2016), a person's educational level will affect the process and ability to think so that they can capture new information. Therefore, a person's education level also influences whether it is easy to absorb and understand information about the birth process.<sup>16</sup> The results of research conducted by Sutrisminah et al. (2021), mothers with low education experience moderate-severe anxiety compared to respondents with higher education. However, this is not the only influencing factor, there are other factors, such as family support, the mother's age, etc.<sup>17</sup> The baby's birth weight in the two groups was mostly between 3000-3500 g. Birth weight is related to head circumference and shoulder width. Birth weight affects pain due to dilation and pressure on the pelvic cavity. This is related to the size of the pelvis, which is considered sufficient for vaginal delivery.

The bivariate analysis results also showed significant differences in the levels of pain and anxiety before and after the intervention. In the intervention group that received aromatherapy of calamansi orange peel essential oil, it was found that the average pain before the intervention was 1.83, which decreased to 1.43 after the intervention was given (0.0001), as well as the level of anxiety, which on average also decreased, namely 2.30 to 1.77 (0.001). The same thing happened to the control group who received citrus aromatherapy, which showed differences in pain and anxiety levels before and after the intervention was given with p-value = 0.005 for pain levels and 0.0003 for anxiety levels. This shows that using aroma therapy in the first

stage of labor as a complementary therapy significantly affects labor pain and anxiety levels.

This study's results align with the results of a meta-analysis which shows that aromatherapy affects relaxing labor pain and anxiety in the active phase.<sup>18,19</sup> Efforts to overcome labor pain with non-pharmacological methods, one of which is aromatherapy. Aromatherapy is the high-end use of aromatic plant oils, which are used in various ways for various therapeutic indications. Various previous studies have shown that aromatherapy can be used safely and effectively in obstetrics.<sup>20</sup> The use of aromatherapy as a complementary and alternative therapy can help relieve maternal anxiety and pain during labor.<sup>12</sup>

The results of this study also showed a significant difference in the level of labor pain and the mother's anxiety level in labor between the intervention and control groups at post-test 1 (0.000) and post-test 2 (0.000). The Mean of the level of pain and anxiety in the intervention group given aromatherapy of calamansi orange peel essential oil was lower than the control group. This study's results align with the research of Scandura et al. using aromatherapy from bitter orange peel (neroli essential oil), which was lower than the control group.<sup>21</sup> This shows that using aromatherapy of the essential oil of Calamansi orange peel is more effective in reducing labor pain compared to the control group using citrus orange aromatherapy. Even though in the 3rd post test when the opening was 9-10 cm, the statistical test analysis results showed no significant relationship.

This could have been caused by the level of pain, which was indeed more severe at opening 9-10 (complete), and it was approaching the second stage where the mother could no longer control the pain and the desire to strain. In addition, it is known that the perception of pain or pain tolerance varies depending on each individual; the intensity of pain during labor affects the psychological condition of the mother, the delivery process, and the condition of the fetus. The intensity of pain during labor affects the mother's psychological condition, the delivery process, and the welfare of the fetus.<sup>1,2</sup>

The use of aromatherapy is known to affect the mother's perception of pain. Aromatherapy has a soothing smell and gives a feeling of comfort and relaxation to the mother's body and mind. Therefore, the pain and anxiety felt by the mother will decrease during the active phase of the first stage of labor. Aromatherapy increases the mother's ability to deal with labor pain because it has analgesic properties and contains ingredients such as Linalyl acetate, which can reduce pain, not only physically but also the burden and perception of pain psychologically.<sup>22</sup> Several limitations of this study need to be studied further. This study has not observed contraction patterns during the first stage of labor. Then, pain and anxiety during labor can be influenced by other factors such as age, family support, culture, and others as external variables that have the potential to be confounding variables.

## CONCLUSION

The results of this study showed that using aromatherapy as a complementary therapy in the first stage of labor affected the level of pain and anxiety in the first stage of labor. The use of aromatherapy of calamansi orange peel essential oil had a significant effect. It was more effective in reducing pain and anxiety in mothers during the active phase of the first stage of labor compared to the group control.

## DISCLOSURE

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### Author Contribution

All authors have contributed similarly to this research process, including conception and design, data collection, data analysis and interpretation of the data, critical revision of the article for important intellectual content, and final approval.

### Conflict of Interest

The author reports no conflicts of interest in this work.

### Ethical Statement

This study has obtained ethical approval from the Health Research Ethics Committee Faculty of Public Health Sriwijaya University with the letter number 320/UN9.FKM/TU.KKE/2022.

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## REFERENCES

1. Lowdermilk D, Perry S, Cashion K. Keperawatan maternitas. 8th ed. North Carolina: Mosby; 2016.
2. Saifuddin A. Ilmu Kebidanan. Yayasan Bina pustaka Sarwono Prawirohardjo; 2020.
3. Gizzo S, Di Gangi S, Noventa M, Bacile V, Zambon A, Nardelli GB. Women's choice of positions during labour: Return to the past or a modern way to give birth? A cohort study in Italy. *Biomed Res Int*. 2014;2014.
4. Sydsjö G, Angerbjörn L, Palmquist S, Bladh M, Sydsjö A, Josefsson A. Secondary fear of childbirth prolongs the time to subsequent delivery. *Acta Obstet Gynecol Scand*. 2013;92(2):210-4.
5. Lawrence A, Lewis L, Hofmery G, Style C. Maternal positions and mobility during first stage labour. *The Cochrane Collaboration*; 2013.
6. Elmitra, Noviyanti Y. Uji sifat fisik sabun padat transparan dari minyak atsiri jeruk kalamansi (*Citrus microcarpa*). *J Akad Farm Pray*. 2020;5(1):40-8.
7. Soraya S. Pengaruh Pemberian Inhalasi Aromaterapi Lemon Citrus Terhadap Penurunan Nyeri Persalinan Kala I Fase Aktif. *J Ilm Kesehat*. 2021;13(2):184-91.
8. Saleh FH, Anindya M, Weliza NP. Pembuatan Minyak Aromaterapi dari Kulit Buah Jeruk Sunkist dan Daun Mint. 2021;1-23.
9. Sinambela NS, Kurnia HD, Tuti T. Kajian Concrete Minyak Atsiri Hasil Samping Padatan Industri Sirup Jeruk Kalamansi (*Citrofortunella Microcarpa*) Dengan Metode Maserasi. Universitas Bengkulu; 2017.
10. Tutuarima T, Dewi KH, Sinambela N. Optimasi Proses Maserasi Hasil Samping Industri Sirup Jeruk Kalamansi (*Citrofortunella microcarpa*). *J Ilm Teknol Pertanian Agrotechno*. 2019;3(2):358.
11. Irmawati S, Baharuddin A. Pengaruh Aromaterapi Bitter Orange Terhadap Nyeri Persalinan Pada Fase Aktif Kala I Di Puskesmas Kulisusu Kabupaten Buton Utara Tahun 2020. *J Kesehat*. 2021;04(02):151-60.
12. Tabatabaeichehr M, Mortazavi H. The Effectiveness of Aromatherapy in the Management of Labor Pain and Anxiety:

- A Systematic Review. *Ethiop J Health Sci.* 2020;30(3):449–58.
13. Purnama Y, Dewiani K, Rahmawati S, Yusanti L, Fitriani N. IDENTIFICATION OF CALAMANSI FRUIT PEEL ESSENTIAL OIL COMPONENTS FROM BENGKULU USING GC-MS. *Pros 2nd Bengkulu Int Conf Heal.* 2022;220974.
  14. Rejeki S, Nurullita U, RN RK. Tingkat nyeri pinggang kala i persalinan melalui teknik Counter-pressure, Teknik Back-effluerage. *J Keperawatan Matern.* 2013;1(2):124–33.
  15. Maryuni. Hubungan Karakteristik Ibu Bersalin dengan Nyeri Persalinan. *J Stikes Siti Hajar.* 2020;2(1):116–22.
  16. Hwari. *Stress, Depresi, Dan Cemas.* Jakarta: EGC; 2016.
  17. Sutrisminah E, Susiloningtyas I, Jayanti M. Hubungan Usia, Paritas, Pendidikan Dan Dukungan Keluarga Dengan Kecemasan Ibu Bersalin Kala I Di Klinik Bersalin Esti Husada Semarang. *J Kebidanan Khatulistiwa.* 2021;7(1):15.
  18. Chen SF, Wang CH, Chan PT, Chiang HW, Hu TM, Tam KW, et al. Labour pain control by aromatherapy: A meta-analysis of randomised controlled trials. *Women and Birth [Internet].* 2019;32(4):327–35. Available from: <https://doi.org/10.1016/j.wombi.2018.09.010>
  19. Ghiasi A, Bagheri L, Haseli A. A Systematic Review on the Anxiolytic Effect of Aromatherapy during the First Stage of Labor. *J Caring Sci.* 2019;8(1):51–60.
  20. Bertone AC, Dekker RL. Aromatherapy in Obstetrics: A Critical Review of the Literature. *Clin Obstet Gynecol.* 2021;64(3):572–88.
  21. Scandurra C, Mezzalana S, Cutillo S, Zapparella R, Statti G, Maldonato NM, et al. The Effectiveness of Neroli Essential Oil in Relieving Anxiety and Perceived Pain in Women during Labor: A Randomized Controlled Trial. *Healthc.* 2022 Feb 1;10(2).
  22. Wijayanti I, Ratnaningsih S. the Effect of Aromaterapy on the Level of Pain in Mother. *Heal Act Ageing 1st Int Respati Heal Conf.* 2019;313–7.



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