



Lemon aromatherapy for emesis gravidarum: A systematic review

Herdian Fitria Widyanto Putri¹, Atik Farokah², Qatrunnada Naqiyyah Khusmitha³

^{1,2,3}Undergraduate Program of Midwifery, Bhakti Wiyata Institute of Health Sciences, Indonesia

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ABSTRACT

Emesis gravidarum is a discomfort that is often experienced by pregnant women in the first trimester. If not treated properly, emesis gravidarum can turn into a worse condition, namely hyperemesis gravidarum. Hyperemesis gravidarum has a negative impact on the mother and fetus. One of the therapies that is currently trending is the use of lemon aromatherapy. This study aims to carry out a systematic review of lemon aromatherapy on the nausea and vomiting scale. A search for English articles was conducted at Willey, ScienceDirect, EBSCO Host, and Google Scholar for the 2018-2022 period. Based on the systematic review conducted, there were four articles that met the criteria. The majority of the articles were conducted with pregnant women in their first trimester. The majority of nausea and vomiting scale assessments used the PUQE. The duration for giving lemon aromatherapy varies: every day for 2 weeks, twice a day for 1 week, twice a day for 3 days, and is unknown. Giving lemon aromatherapy can reduce the scale of nausea and vomiting in pregnant women with emesis gravidarum.

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Corresponding Author:

Herdian Fitria Widyanto Putri,
Undergraduate Program of Midwifery,
Bhakti Wiyata Institute of Health Sciences,
KH Wachid Hasyim Street No.65, Bandar Lor, Mojoroto, Kediri, East Java 64114.
Email: herdian.putri@iik.ac.id

1. INTRODUCTION

Pregnancy causes changes in women both anatomically and physiologically. During pregnancy, there is an increase in several hormones, such as estrogen, progesterone, and hCG. One of the effects of the increase in these hormones is emesis gravidarum.

Emesis gravidarum, or nausea and vomiting in pregnancy, is a discomfort that often occurs in pregnant women (70%) (Fejzo et al., 2019). Eighty percent of women admit that they experience emesis gravidarum throughout the day, so the term morning sickness is inappropriate (Fejzo et al., 2019). Emesis gravidarum occurs as early as the 6-8th week and will decrease in incidence when entering the 16-20th week of gestation (ACOG, 2020; NHS, 2021). Severe, prolonged, and persistent emesis gravidarum causing dehydration will become hyperemesis gravidarum.

Previous research has described some of the adverse effects on women with hyperemesis gravidarum if not handled properly, such as vitamin deficiency, dehydration, malnutrition, depression, and anxiety during pregnancy (Jennings & Mahdy, 2022). Whereas in the fetus it can cause growth disturbances, low birth weight, premature birth, and lower APGAR scores in the first minute of birth (Fiaschi et al., 2018; Reissland et al., 2023).

Seeing the bad impact, midwives, as the frontline, can provide therapy so that emesis does not turn into hyperemesis gravidarum. Treatments that can be given include administering vitamin B6, asking the mother to eat in small portions, and avoiding spicy foods and strong odors (Maltepe & Koren, 2013). Many non-pharmacological therapies for emesis gravidarum have been developed, such as aromatherapy (Sumah et al., 2021). Aromatherapy is the use of essential oils from plants such as seeds, stems, leaves, petals, flowers, nuah skin, fruit, kahu, roots, rhizomes, and grass, either inhaled or rubbed (Farrar & Farrar, 2020; NIH, 2023). Oils that are often used in aromatherapy are lavender, tea tree, lemon, ginger, and others. Lemon is one of the oils that has a refreshing effect (Fibriansari & Hayati, 2023). The lemon essential oil comes from the extraction of lemon peel, which is rich in flavonoids like B6, limonene, linalool, and linalyl acetate. These ingredients are proven to reduce the scale of nausea and vomiting in first-trimester pregnant women (Mutiah et al., 2021; Yulyana, 2023). Lemon aromatherapy is safe for pregnant women and women in childbirth (Vitrianingsih & Khadijah, 2019). Researchers are interested in reviewing several existing experimental studies related to the effects of lemon aromatherapy on emesis gravidarum. The difference from previous research is that this research is a systematic literature review using English-language journals, determining the quality of journals with a checklist from the Joanna Briggs Institute (JBI), and reviewing journals with the PICO method. This study aims to collect research results on the effects of lemon aromatherapy to reduce emesis gravidarum, which can be used as evidence-based practice in midwifery.

Emesis gravidarum often appears in first-trimester pregnant women. The pathogenesis of emesis gravidarum involves multiple factors, such as genetic, endocrine, gastrointestinal, and psychological factors. Women whose mothers have a history of emesis gravidarum have a three-times higher risk of experiencing emesis gravidarum (Zhang et al., 2011). Encoding growth/differentiation factor 15 (GDF1) and human chorionic gonadotropin (hCG) are hormones that have high levels in early pregnancy when the symptoms of emesis gravidarum and hyperemesis gravidarum appear. These two hormones are believed to play an important role in the pathogenesis of emesis gravidarum (Derbent et al., 2011; Fejzo et al., 2019). Gastrointestinal dysmotility is affected by serotonin receptors, PGR (encoding the progesterone receptor), and GDF15 (Fejzo et al., 2019). Psychological status influences the incidence of nausea and vomiting in pregnancy. Fear, refusing to get pregnant, refusing to become a mother, unwanted pregnancies, and anxiety affect the appearance of nausea and vomiting. Nausea and vomiting are controlled by the nervous system, and it is suspected that anxiety plays a role in activating these conditions (Shakiba et al., 2019).

Severe emesis gravidarum can affect the quality of life of pregnant women both physiologically and psychologically (Hirose et al., 2020). Physiologically, the mother will become weak, physical activity will be disrupted, and nutrition for the fetus will not be optimal. As a result, fetal growth and development are hampered, and babies are born with low birth weight, a small gestational age, premature birth, and poor outcomes (Gu et al., 2021; Regodón Wallin et al., 2020). Meanwhile, psychologically, it can make the mother depressed during pregnancy. Depression is a condition in which a person feels sad, irritable, loses concentration, experiences anhedonia, despair, a loss of appetite, sleep disturbances, and a feeling of wanting to commit suicide. Depression in early pregnancy has a positive relationship with premature birth, small gestational age, stillbirth, low birth weight, high maternal morbidity such as perinatal complications, increased operative deliveries, and postpartum depression (Acheampong et al., 2021; Jahan et al., 2021).

Management of emesis gravidarum starts with lifestyle changes, complementary therapies, and pharmacology. Complementary therapies such as aromatherapy can be used when lifestyle changes do not reduce nausea and vomiting (Fejzo et al., 2019; Liu et al., 2022). The mechanism of action of aromatherapy involves the integration of essential oils into the biological signals of receptor cells in the nose. The signal is transmitted to the limbic and hypothalamus parts of the brain. As a result, the brain releases neurotransmitters such as serotonin, endorphins, and others that can improve emotional health, calmness, and relaxation, so that the incidence of emesis gravidarum decreases (Ali et al., 2015; Shakiba et al., 2019).

2. RESEARCH METHOD

This research is a systematic literature review using PRISMA (Preferred Reporting Items for Literature Review and Meta-Analyses). Stage 1: Search for articles using electronic databases, including Willey, ScienceDirect, EBSCO Host, and Google Scholar, with keywords as in Table 1. The articles obtained are adjusted to the inclusion criteria (table 2). Stage 2: screened articles to eliminate the same titles. Stage 3: Articles were processed using a quasi-experimental research checklist and a randomized control trial (RCT) from the Joanna Briggs Institute (JBI) to determine quality. Assessment is done by giving a value of 1 for the answer "yes" and 0 for the answer "no, unclear, or not applicable". Then the result is divided by the total number of questions and multiplied by 100%. Good quality is if the score is 80–100%, sufficient quality is 50–79%, and less quality is <50%. Stage 4: Articles that have good quality are reviewed using the PICO model: P (population), I (intervention), C (comparison), and O (outcome). The PICO formulation in this article can be seen in Table 1. Data analysis was carried out descriptively by comparing the results of research between articles on the topic of the effects of lemon aromatherapy on emesis gravidarum.

Table 1. keyword

Population	Intervention	Comparison	Outcome
Pregnant	Aromatherapy	Placebo	Nausea
Pregnancy	Inhalation		Vomit
	Lemon		Vomiting
	Citrus lemon		Morning sickness
			Emesis
			Emesis gravidarum

Table 2. inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Period	Published less than 5 years (2018-2022)	Published before 2018
Language	English	Not English
Subject	Pregnant	Not pregnant
Article type	Original article, research article, full text,	Review article
Research design	experimental research	Non experimental
	Experimental (RCT dan quasi experimental)	

Based on table 2, the inclusion criteria in this study were articles published in 2018–2022, in English, using pregnant women as subjects, original articles, research articles, full text, experimental research, and research designs using randomized control trials and quasi-experimental. While the exclusion criteria were articles published before 2018, languages other than English, not pregnant women, article reviews, and not experimental research.

3. RESULTS AND DISCUSSIONS

Article search results

The search results for data from Willey, ScienceDirect, EBSCO Host, and Google Scholar with keywords in Table 1 obtained 11,318 articles. The articles were screened, and the results showed 11,181 duplicate articles. Of the 137 articles, the titles were sorted according to the criteria, and 18 articles were obtained. The eligibility process was carried out for the eighteen articles, and four articles were found that deserved to be reviewed (Figure 1). The four selected articles are quasi-experimental and have good quality after being tested using The Joanna Briggs method (tables 3 and 4).

Study characteristics

All articles found were the result of research conducted in Indonesia (n = 4). The majority of articles 1, 2, and 4 conducted research on pregnant women in the 1st trimester. Article 3 was carried out during pregnancy, regardless of gestational age. All articles assessed the nausea-vomiting scale before and after being given lemon aromatherapy. Article 1.2 uses PUQE, while Article 3.4 does not

know the type of questionnaire. The majority of articles 2, 3, and 4 do not use a control group; article 1 does (table 3). The procedure for using lemon aromatherapy in article 1 is done every day for 2 weeks using electric aromatherapy; article 2 is done twice a day for 1 week with tissue dripped with aromatherapy; and article 3 is done twice a day for 3 days using electric aromatherapy. Article 4 does not describe the procedure for using lemon aromatherapy.

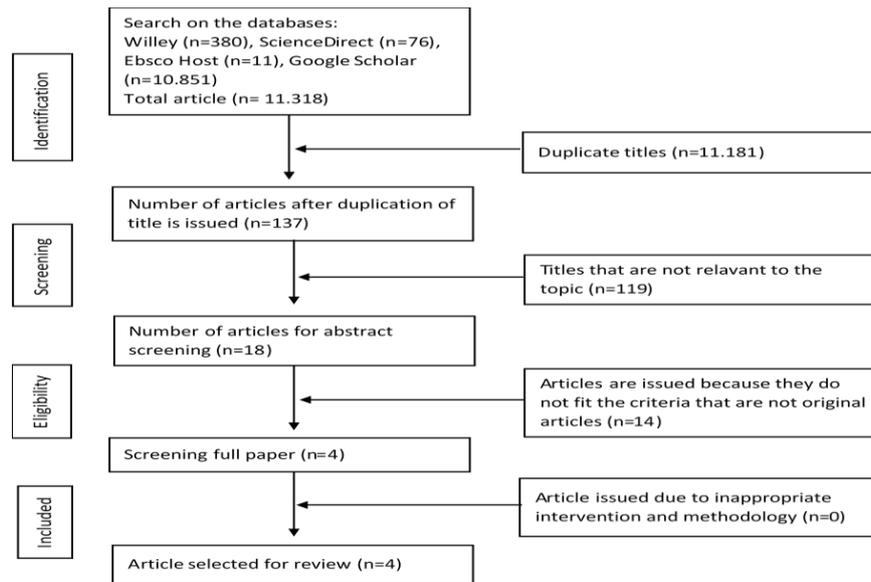


Figure 1. Alur seleksi artikel

Table 3. Quasi experimental article assessment (the Joanna Briggs Institute)

Items	Assessment			
	1	2	3	4
Is it clear in the study what is the 'cause' dan what is the 'effect' (i.e. there is no confusion about which variable comes first)?	Y	Y	Y	Y
Were the participants included in any comparisons similar?	Y	Y	Y	Y
Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	Y	Y	Y	Y
Was there a control group?	Y	N	N	N
Were there multiple measurements of the outcome pre dan post the intervention/exposure?	Y	Y	Y	Y
Was follow up complete dan if not, were differences between groups in terms of their follow up adequately described dan analyzed?	Y	Y	Y	Y
Were the outcomes of participants included in any comparisons measured in the same way?	Y	Y	Y	Y
Were outcomes measured in a reliable way?	Y	Y	Y	Y
Was appropriate statistical analysis used?	Y	Y	Y	Y

Table 4. Result of article quality assessment

No	Article title	Writer	Year	Critical appraised RCT/ Quasi experiment	Evaluation quality
1	Effect Of Lemon Aromatherapy On Decline Nausea And Vomiting In Pregnant Women In The First Trimester At The Abepura Health Center In Jayapura City	Suryati Romauli, Flora Niu	2022	100%	Good
2	The Effect of Citrus	Bunga Tiara	2020	88,9%	Good

No	Article title	Writer	Year	Critical appraised RCT/ Quasi experiment	Evaluation quality
3	lemon Aromatherapy on Emesis Gravidarum Patient The Influence of Giving Lemon Aroma therapy on Pregnant Women with Emesis gravidarum	Carolin, Siti Syamsiah, Rian Yuniati Meteria Simbolon, Fitriyaningsih, Trifonia MK Koli	2022	88,9%	Good
4	Lemon Suangi (Citrus limon) Aromatherapy to Reduce Vomitting on Early First Trimester Pregnancy at Teling Public Health Center Wanea District Manado City	Atik Purwandari, Sjenny Tuju, Freike Lumy, Winny Anisa	2019	88,9%	Good

Table 5. Summary of article review (PICO)

Journal	Desain	Population	Intervention	Compare/control	Outcome
Effect Of Lemon Aromatherapy On Decline Nausea And Vomiting In Pregnant Women In The First Trimester At The Abepura Health Center In Jayapura City (Romauli & Niu, 2022)	Quasi experiment	28 first trimester pregnant women with experiencing nausea and vomiting, 11 respondent aged 20-35 years, 1 respondent aged >35 years, 2 respondent aged <20 years, education low-intermediate (elementary-senior high school), work and not working, all parity was join	Respondent give lemon aromatherapy via inhalation for around five minutes every day for two weeks	Didn't give lemon aromatherapy	Lemon aromatherapy had a significant effect on decreasing morning sickness and vomiting in 1st trimester pregnant women (p=0.000)
The Effect of Citrus lemon Aromatherapy on Emesis Gravidarum Patient (Carolin et al., 2020)	Quasi experiment	30 first trimester pregnant mothers experiencing morning sickness symptom, 19 respondent aged 20-35 years, 6 respondent aged >35 years, 5 respondent aged <20 years, all parity was join	Respondent using tissue that has been given 3 drops of citrus lemon and inhaled for 5 minutes and repeated for twice a day for 7 days.	-	there is difference in morning sickness level of first trimester mothers before and after given citrus lemon aromatherapy (p=0.000)
The Influence of Giving Lemon Aroma therapy on Pregnant Women with Emesis gravidarum (Simbolon & Koli, 2022)	Quasi experiment	10 pregnant women who experience emesis gravidarum in all weeks gestation, aged 20-35 years, primigravida and	Respondent give lemon aromatherapy inhalation	-	There is a decrease in the average score of the emesis gravidarum level before and after given aroma therapy Lemons

Journal	Desain	Population	Intervention	Compare/control	Outcome
Lemon Suangi (Citrus limon) Aromatherapy to Reduce Vomitting on Early First Trimester Pregnancy at Teling Public Health Center Wanea District Manado City	Quasi experiment	multigravida, 15 respondents of 1st Trimester Pregnant Women who experienced nausea and vomiting, aged 20-30 years, primigravida and multigravida	Respondent give aromatherapy lemon Suangi every day at. 06:00 and o'clock. 18.00 WITA for 3 days	-	(p=0.000) There are differences in the frequency of nausea and vomiting in 1st trimester pregnant women after being given an intervention (p=0.000)

Discussion

The discomfort that often occurs in the first trimester of pregnant women is emesis gravidarum. Emesis gravidarum is caused by an increase in the hormone chorionic gonadotropin (hCG) on days 60 and 70. Apart from hCG, there was an increase in estrogen and progesterone. As a result, there are changes in the digestive system, such as an increase in the amount of saliva, decreased levels of stomach acid, and intestinal motility. Previous studies have stated that giving lemon aromatherapy can reduce the frequency of nausea and vomiting. Lemon can increase gastrointestinal peristalsis, control cyclooxygenases 1 and 2, and block serotonin in the limbic system (Purwandari et al., 2019; Romauli & Niu, 2022).

All articles are quasi-experimental research. This was chosen because the researcher wanted to know cause and effect by involving the experimental group and the control group, as well as before and after treatment evaluation. Quasi-experimental research does not have strict limitations on randomization and can control validity threats (Abraham & Supriyati, 2022). The advantage of pre-test and post-test research designs is that research has direction (Stratton, 2019). So this study makes it clear that the independent variable (lemon aromatherapy) affects the dependent variable (level of nausea).

The majority of articles use samples of first-trimester pregnant women who experience emesis gravidarum. This is due to the influence of hCG. While the sample used in Article 3 does not look at the mother's trimester, This is because emesis gravidarum can continue in the 2nd and 3rd trimesters due to an increase in GDF15. GDF15 is a member of the Transforming Growth Factor (TGF) family that is secreted by the placenta. TGF- plays a role in the pathogenesis of cases of hyperemesis gravidarum (Liu et al., 2022; Lockhart et al., 2020; Uhlén et al., 2015).

In assessing the nausea and vomiting scale, articles 1 and 2 used the PUQE. PUQE, or the 24-hour pregnancy unique quantification of emesis and nausea, is a tool to assess a scale of nausea (duration of nausea), vomiting (number of vomiting episodes), and retching (number of vomiting episodes) over the last 24 hours. Each criterion has a 5-point scale. The higher the total score, the more severe the level of nausea and vomiting during pregnancy (Ebrahimi et al., 2009; Hada et al., 2021). The advantage of using PUQE is that it can avoid subjectivity. Meanwhile, articles 3 and 4 do not explain the use of tools to assess the nausea and vomiting scale.

During the intervention process, lemon aromatherapy was given by inhalation, either using a tissue that was given lemon aromatherapy or electrically. The inhalation method was chosen because it is faster, more comfortable, and safer. When aromatherapy is given by inhalation, the essential oil will evaporate and come into contact with the cilia of the nasal mucosa, thus affecting the limbic system and hypothalamus, which produces a sedative effect on the nervous and endocrine systems (Hedigan et al., 2023; Pratiwi & Subarnas, 2020).

The time for giving lemon aromatherapy in the articles reviewed varies greatly; some are done every day for 2 weeks, twice a day for 1 week, twice a day for 3 days, and some do not explain the procedure for using lemon aromatherapy. Although the duration of using lemon aromatherapy varies, all articles show significant results.

The advantage of this research is that the process is carried out in stages according to the PRISMA rules.

4. CONCLUSION

Emesis gravidarum is a discomfort that is often suffered by pregnant women, especially in the 1st trimester, although it does not rule out the possibility of occurring in pregnant women in the 2nd and 3rd trimesters. Based on a systematic literature review, giving lemon aromatherapy can significantly reduce the scale of nausea and vomiting in pregnant women with emesis gravidarum. The results of this study are expected to provide an evidence base for midwives or other health workers to provide easy non-pharmacological treatment for pregnant women with emesis gravidarum to prevent hyperemesis gravidarum. Suggestions for further research are to use more databases (> 4 databases).

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REFERENCES

- Abraham, I., & Supriyati, Y. (2022). Desain Kuasi Eksperimen Dalam Pendidikan: Literatur Review. *Jurnal Ilmiah Mandala Education*, 8(3), 2476–2482. <https://doi.org/10.58258/jime.v8i3.3800>
- Acheampong, K., Pan, X., Kaminga, A. C., Wen, S. W., & Liu, A. (2021). Risk of adverse maternal outcomes associated with prenatal exposure to moderate-severe depression compared with mild depression: A fellow-up study. *Journal of Psychiatric Research*, 136, 32–38. <https://doi.org/https://doi.org/10.1016/j.jpsychires.2021.01.036>
- ACOG. (2020). *Morning Sickness: Nausea and Vomiting of Pregnancy*. ACOG. <https://www.acog.org/womens-health/faqs/morning-sickness-nausea-and-vomiting-of-pregnancy>
- Ali, B., Al-Wabel, N. A., Shams, S., Ahamad, A., Khan, S. A., & Anwar, F. (2015). Essential oils used in aromatherapy: A systemic review. *Asian Pacific Journal of Tropical Biomedicine*, 5(8), 601–611. <https://doi.org/https://doi.org/10.1016/j.apjtb.2015.05.007>
- Carolin, B. T., Syamsiah, S., & Yuniati, R. (2020). The Effect of Citrus lemon Aromatherapy on Emesis Gravidarum Patient. *STRADA Jurnal Ilmiah Kesehatan*, 9(2), 599–604.
- Derbent, A. U., Yanik, F. F., Simavli, S., Atasoy, L., Urün, E., Kuşçu, U. E., & Turhan, N. Ö. (2011). First trimester maternal serum PAPP-A and free β -HCG levels in hyperemesis gravidarum. *Prenatal Diagnosis*, 31(5), 450–453. <https://doi.org/10.1002/pd.2715>
- Ebrahimi, N., Maltepe, C., Bournissen, F. G., & Koren, G. (2009). Nausea and Vomiting of Pregnancy: Using the 24-hour Pregnancy-Unique Quantification of Emesis (PUQE-24) Scale. *Journal of Obstetrics and Gynaecology Canada*, 31(9), 803–807. [https://doi.org/https://doi.org/10.1016/S1701-2163\(16\)34298-0](https://doi.org/https://doi.org/10.1016/S1701-2163(16)34298-0)
- Farrar, A. J., & Farrar, F. C. (2020). Clinical Aromatherapy. *Nursing Clinics of NA*, 55(4), 489–504. <https://doi.org/10.1016/j.cnur.2020.06.015>
- Fejzo, M. S., Trovik, J., Grooten, I. J., Sridharan, K., Roseboom, T. J., Vikanes, Å., Painter, R. C., & Mullin, P. M. (2019). Nausea and vomiting of pregnancy and hyperemesis gravidarum. *Nature Reviews. Disease Primers*, 5(1), 62. <https://doi.org/10.1038/s41572-019-0110-3>
- Fiaschi, L., Nelson-Piercy, C., Gibson, J., Szatkowski, L., & Tata, L. J. (2018). Adverse Maternal and Birth Outcomes in Women Admitted to Hospital for Hyperemesis Gravidarum: a Population-Based Cohort Study. *Paediatric and Perinatal Epidemiology*, 32(1), 40–51. <https://doi.org/10.1111/ppe.12416>
- Fibriansari, R. D., & Hayati, N. (2023). EFFECT OF LEMON AROMATHERAPY IN PREGNANT WOMEN ON EMESIS GRAVIDARUM: A LITERATURE REVIEW. *Journal of Vocational Nursing*, 4(1), 13–20. <https://e-journal.unair.ac.id/JoViN/article/download/43437/24799>
- Gu, L., Mo, M., Si, S., Luo, W., Shao, B., Xin, X., Chen, D., Jiang, W., & Yu, Y. (2021). Association of nausea and vomiting of pregnancy with infant growth in the first 24 months of life. *Archives of Gynecology and Obstetrics*, 304(2), 429–438. <https://doi.org/10.1007/s00404-021-06046-2>
- Hada, A., Minatani, M., Wakamatsu, M., Koren, G., & Kitamura, T. (2021). The Pregnancy-Unique Quantification of Emesis and Nausea (PUQE-24): Configural, Measurement, and Structural Invariance between Nulliparas and Multiparas and across Two Measurement Time Points. *Healthcare (Basel, Switzerland)*,

- 9(11). <https://doi.org/10.3390/healthcare9111553>
- Hedigan, F., Sheridan, H., & Sasse, A. (2023). Benefit of inhalation aromatherapy as a complementary treatment for stress and anxiety in a clinical setting – A systematic review. *Complementary Therapies in Clinical Practice*, 52, 101750. <https://doi.org/https://doi.org/10.1016/j.ctcp.2023.101750>
- Hirose, M., Tamakoshi, K., Takahashi, Y., Mizuno, T., Yamada, A., & Kato, N. (2020). The effects of nausea, vomiting, and social support on health-related quality of life during early pregnancy: A prospective cohort study. *Journal of Psychosomatic Research*, 136, 110168. <https://doi.org/https://doi.org/10.1016/j.jpsychores.2020.110168>
- Jahan, N., Went, T. R., Sultan, W., Sapkota, A., Khurshid, H., Qureshi, I. A., & Alfonso, M. (2021). Untreated Depression During Pregnancy and Its Effect on Pregnancy Outcomes: A Systematic Review. *Cureus*, 13(8), e17251. <https://doi.org/10.7759/cureus.17251>
- Jennings, L. ., & Mahdy, H. (2022). *Hyperemesis Gravidarum*. StatPearls Publishing. <https://www.ncbi.nlm.nih.gov/books/NBK532917/>
- Liu, C., Zhao, G., Qiao, D., Wang, L., He, Y., Zhao, M., Fan, Y., & Jiang, E. (2022). Emerging Progress in Nausea and Vomiting of Pregnancy and Hyperemesis Gravidarum: Challenges and Opportunities. *Frontiers in Medicine*, 8. <https://doi.org/10.3389/fmed.2021.809270>
- Lockhart, S. M., Saudek, V., & O'Rahilly, S. (2020). GDF15: A Hormone Conveying Somatic Distress to the Brain. *Endocrine Reviews*, 41(4). <https://doi.org/10.1210/endo/bnaa007>
- Maltepe, C., & Koren, G. (2013). The management of nausea and vomiting of pregnancy and hyperemesis gravidarum. *J Popul Ther Clin Pharmacol*, 20(2), 184–192.
- Mutiah, C., Veri, N., Magfirah, M., Fazdria, F., AS, E., & Abdurrahman, A. (2021). Pemanfaatan Jeruk Bali (Citrus Grandis) Dan Jeruk Lemon (Citrus Limon) Terhadap Penurunan Mual Muntah Pada Ibu Hamil di Desa Karang Anyar Langsa Baro Kota Langsa. *Jurnal Kreativitas Pengabdian Kepada Masyarakat (PKM); Volume 4 Nomor 6 Desember 2021*. <https://doi.org/10.33024/jkpm.v4i6.4463>
- NHS. (2021). *Vomiting and morning sickness*. NHS. <https://www.nhs.uk/pregnancy/related-conditions/common-symptoms/vomiting-and-morning-sickness/>
- NIH. (2023). *Aromatherapy*. NCCIH. <https://www.nccih.nih.gov/health/aromatherapy>
- Pratiwi, F., & Subarnas, A. (2020). Aromaterapi Sebagai Media Relaksasi. *Farmaka*, 18(3), 66–75. <https://jurnal.unpad.ac.id/farmaka/article/view/27910>
- Purwandari, A., Tuju, S., Lumy, F., & Anisa, W. (2019). Lemon Suangi (Citrus limon) Aromatherapy to Reduce Vomitting on Early Dirst Trimester Pregnancy at Teling Public Health Center Wanea District Manado City. *Proceeding 2nd Manado Health Polytechnic International Conference*, 39–44.
- Regodón Wallin, A., Tielsch, J. M., Khatry, S. K., Mullany, L. C., Englund, J. A., Chu, H., LeClerq, S. C., & Katz, J. (2020). Nausea, vomiting and poor appetite during pregnancy and adverse birth outcomes in rural Nepal: an observational cohort study. *BMC Pregnancy and Childbirth*, 20(1), 545. <https://doi.org/10.1186/s12884-020-03141-1>
- Reissland, N., Matthewson, J., & Einbeck, J. (2023). Association between Hyperemesis Gravidarum in pregnancy on postnatal ability of infants to attend to a play task with their mother. *Infant Behavior and Development*, 71, 101823. <https://doi.org/https://doi.org/10.1016/j.infbeh.2023.101823>
- Romauli, S., & Niu, F. (2022). EFFECT OF LEMON AROMATHERAPY ON DECLINE NAUSEA AND VOMITING IN PREGNANT WOMEN IN THE FIRST TRIMESTER AT THE ABEPURA HEALTH CENTER IN JAYAPURA CITY. *INTERNATIONAL JOURNAL OF NURSING AND MIDWIFERY SCIENCE (IJNMS)*, 6(3), 202–213.
- Shakiba, M., Parsi, H., Pahlavani Shikhi, Z., & Navidian, A. (2019). The Effect of Psycho-Education Intervention Based on Relaxation Methods and Guided Imagery on Nausea and Vomiting of Pregnant Women. *Journal of Family & Reproductive Health*, 13(1), 47–55.
- Simbolon, M., & Koli, T. M. K. (2022). The Influence of Giving Lemon Aromatherapy on Pregnant Women with Emesis gravidarum. *Science Midwifery*, 10(5), 4088–4093.
- Stratton, S. J. (2019). Quasi-Experimental Design (Pre-Test and Post-Test Studies) in Prehospital and Disaster Research. *Prehospital and Disaster Medicine*, 34(6), 573–574. <https://doi.org/DOI:10.1017/S1049023X19005053>
- Sumah, D. F., Madiuw, D., Tasijawa, F. A., & Leutualy, V. (2021). Non-pharmacologic intervention for nausea and vomiting of pregnancy: Systematic Review. *Jurnal Aisyah: Jurnal Ilmu Kesehatan*, 6(4), 663–672.
- Uhlén, M., Fagerberg, L., Hallström, B. M., Lindskog, C., Oksvold, P., Mardinoglu, A., Sivertsson, Å., Kampf, C., Sjöstedt, E., Asplund, A., Olsson, I., Edlund, K., Lundberg, E., Navani, S., Szgyarto, C. A.-K., Odeberg, J., Djureinovic, D., Takanen, J. O., Hober, S., ... Pontén, F. (2015). Proteomics. Tissue-based map of the human proteome. *Science (New York, N.Y.)*, 347(6220), 1260419. <https://doi.org/10.1126/science.1260419>

- Vitrianingsih, V., & Khadijah, S. (2019). Efektivitas Aroma Terapi Lemon untuk Menangani Emesis Gravidarum. *Jurnal Keperawatan*, 11(4), 277-284. <https://doi.org/10.32583/keperawatan.v11i4.598>
- Yulyana, M. (2023). Perbandingan Pemberian Aromaterapi Lavender Dan Lemon Terhadap Nyeri Persalinan Kala I Pada Ibu Bersalin Di Wilayah Puskesmas Cimanggu Pandeglang Banten Tahun 2022. *Dohara Publisher Open Access Journal*, 02(06), 718-728.
- Zhang, Y., Cantor, R. M., MacGibbon, K., Romero, R., Goodwin, T. M., Mullin, P. M., & Fejzo, M. S. (2011). Familial aggregation of hyperemesis gravidarum. *American Journal of Obstetrics and Gynecology*, 204(3), 230.e1-230.e7. <https://doi.org/https://doi.org/10.1016/j.ajog.2010.09.018>