Original Article

Effectiveness of Lemongrass (Cymbopogon citratus) Decoction as a Non-Hormonal Therapy for Preventing Early Menopause Among Women Aged 40–45 Years in Indonesia: A Randomized Controlled Trial

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ABSTRACT

Background: Early menopause (before age 45) increases risks of osteoporosis, cardiovascular disease, and reduced quality of life. Although hormonal therapy is effective, its adverse effects have driven interest in safer alternatives. However, evidence on community-based herbal interventions for preventing early menopause is scarce in Indonesia. This study examined the effectiveness of Cymbopogon citratus (lemongrass) decoction as a low-cost, non-hormonal preventive therapy for early menopause.

Methods: This parallel two-arm randomized controlled trial, conducted in Perbulan Village, Karo Regency, involved 30 women aged 40–45 years, randomly assigned to an intervention group receiving lemongrass decoction and a control group. Participants consumed 250 ml of decoction daily for 30 days. Menopausal symptoms were measured using the Menopause Rating Scale (MRS) and menstrual cycle regularity was recorded. Data were analyzed with the Mann–Whitney U test following the CONSORT 2010 guidelines, with statistical significance set at $p < 0.05$ and 95% confidence intervals (CI) reported. Ethical approval was obtained from the institutional review board.

Results: Mean MRS scores in the intervention group decreased significantly from 20.5 ± 2.0 to 13.4 ± 1.6 ($p < 0.001$, 95% CI [5.7, 8.4], $d = 1.45$, large effect), while the control group showed no significant change. Menstrual cycle regularity improved in 73.3% of intervention participants compared with 13.3% in controls ($p < 0.001$). Compliance was high (86.7%) and no adverse events were reported.

Conclusion: Lemongrass decoction effectively reduced menopausal symptoms and regulated menstrual cycles, supporting its use as a safe, acceptable, and affordable non-hormonal option for community-based women's health promotion. The findings suggest potential integration of herbal therapy education into midwifery and public health programs to strengthen preventive reproductive care.

Keywords: Complementary Therapy; Cymbopogon citratus; Early Menopause; Lemongrass; Menopausal Symptoms; Randomized Controlled Trial

Implications for Practice:

- The findings suggest that incorporating lemongrass decoction as a complementary herbal option can enhance clinical practice in managing menopausal symptoms through safe, non-hormonal interventions.
- Policymakers should consider integrating community-based herbal therapy programs into national

Implications for Practice:

reproductive health strategies to strengthen promotive and preventive care.

- Incorporating herbal therapy education into midwifery curricula may improve culturally appropriate care, particularly relevant for resource-limited settings in low- and middle-income countries.

Introduction

The prevalence of premature menopause (before age 45) is a global concern due to its significant impact on women's health. Internationally, approximately 12% of women experience premature menopause, while premature menopause (before age 40) occurs in 1–4% of women. (Golezar et al., 2019). In developing countries, including Indonesia, the average age of menopause ranges from 47–50 years, but the prevalence of early and premature menopause tends to be higher than in developed countries, with variations influenced by ethnic, social, and environmental factors (Leone et al., 2023). Early menopause increases the risk of osteoporosis, cardiovascular disease, cognitive decline, type 2 diabetes, and premature mortality (Peycheva et al., 2022). This risk is greater if menopause occurs at a younger age and can be exacerbated by comorbidities such as diabetes (Yoshida et al., 2021).

Menopause is a natural biological process that marks the end of a woman's reproductive years, typically occurring between the ages of 45 and 55. However, premature menopause, defined as the permanent cessation of menstruation before the age of 45 due to ovarian failure, leads to decreased estrogen production and hormonal imbalance (Sochocka et al., 2023). This condition can occur spontaneously or as a result of medical procedures such as chemotherapy or ovarian surgery, and is associated with an increased risk of osteoporosis, cardiovascular disease, cognitive impairment, and a reduced quality of life (Hamoda & Sharma, 2024). The prevalence of premature menopause is influenced by genetic, environmental, and lifestyle factors, such as family history, smoking, poor nutrition, toxin exposure, and chronic stress (Giri & Vincent, 2020). Other identified risk factors include early menarche, low parity, and low socioeconomic status (Zhong et al., 2024).

Hormone replacement therapy (HRT) has long been used to manage menopausal symptoms, but concerns about side effects such as increased risk of breast cancer, stroke, and thromboembolism have fueled interest in safer, non-hormonal alternatives and complementary therapies (Madsen et al., 2023). Herbal-based interventions are gaining increasing attention because they are perceived as more culturally acceptable and accessible, particularly in rural communities with limited access to healthcare (Mohapatra et al., 2024). Several herbs, such as black cohosh, red clover, and chamomile, have been studied and shown potential in alleviating menopausal symptoms, although evidence of their effectiveness and safety remains variable and often inconsistent. Despite widespread herbal use, no community-based herbal interventions for the prevention of premature menopause have been systematically evaluated, representing a significant research gap in women's health promotion efforts in Indonesia (Kenda et al., 2021).

Cymbopogon citratus (lemongrass) is a widely used medicinal plant rich in bioactive compounds such as citral, flavonoids, and phenolic acids. These compounds are known to possess antioxidant and anti-inflammatory properties, as well as hormone-modulating potential. Flavonoids in lemongrass,

particularly C-glycosylflavones, play a key role in antioxidant and anti-inflammatory activity and have been shown to influence various biological pathways related to reproductive and metabolic health (Sousa et al., 2021). Several studies have shown that flavonoids and phenolic compounds in lemongrass can scavenge free radicals, reduce inflammation, and potentially modulate the activity of steroid hormones, including estrogen (Hu et al., 2023; Tazi et al., 2024). This estrogenic activity of flavonoids is thought to occur through interactions with estrogen receptors, both ER-α and ER-β, thereby supporting ovarian function and potentially delaying menopause (Bolt et al., 2024).

The increasing prevalence of non-communicable diseases (NCDs) such as heart disease, diabetes, and hormonal disorders has become a major public health challenge in Indonesia, replacing the dominance of infectious diseases. To respond to this change, a community-based approach that emphasizes education, empowerment, and the utilization of local resources is essential to strengthen health prevention and promotion efforts (Sulaiman et al., 2024). The use of local herbal plants such as lemongrass (Cymbopogon citratus) aligns with the Healthy Indonesia Program and the Sustainable Development Goals (SDG 3), which emphasize equitable access to health through promotive and preventive approaches (Suharti et al., 2021). This study aimed to evaluate the effectiveness of lemongrass (*Cymbopogon citratus*) decoction as a non-hormonal complementary therapy for preventing early menopause among women aged 40–45 years.

Methods

Study Design

This study was a parallel two-arm randomized controlled trial (RCT) that adhered to the CONSORT 2010 guidelines (Schulz et al., 2010). The research aimed to evaluate the effectiveness of Cymbopogon citratus (lemongrass) decoction as a non-hormonal complementary therapy to prevent early menopause among women aged 40–45 years in Perbulan Village, Karo Regency.

Participants

A total of 30 women meeting the inclusion criteria were randomly assigned to intervention and control groups, with 15 participants in each. Inclusion criteria were women aged 40–45 years, not using hormonal therapy, willing to participate, and providing informed consent. Exclusion criteria included chronic diseases, pregnancy, breastfeeding, or allergies to lemongrass. Randomization was conducted using computer-generated numbers with allocation concealment via sealed opaque envelopes. No dropout occurred, and retention reached 100%. Sample size was estimated using G*Power 3.1 with an assumed large effect size (0.8), $\alpha = 0.05$, and power = 0.80, indicating a minimum of 26 participants; hence, 30 were recruited to ensure adequacy. The study also served as a pilot trial for future community-based interventions.

The study participants were women aged 40–45 years residing in Perbulan Village, Karo Regency, who met the eligibility criteria. A total of [insert number] participants were enrolled after screening for inclusion and exclusion requirements.

Inclusion criteria included: (1) women aged 40–45 years, (2) not undergoing hormonal or alternative therapy related to menopause, (3) willing to consume lemongrass (Cymbopogon citratus) decoction as part of the intervention, and (4) providing written informed consent. Exclusion criteria included: (1) history of severe chronic diseases such as cardiovascular disease, cancer, or diabetes

mellitus, (2) currently pregnant or breastfeeding, and (3) known allergies to lemongrass.

All eligible participants were randomized into two groups: the intervention group, which received the lemongrass decoction, and the control group, which did not receive the intervention. Random assignment was carried out to ensure comparability between groups and to reduce potential bias.

Instruments

Data were collected using the Menopause Rating Scale (MRS) and the Greene Climacteric Scale (GCS), both validated and widely used to assess menopausal symptoms. The MRS includes 11 items across psychological, somatic, and urogenital domains scored on a 5-point scale (0–4), with total scores ranging from 0–44 (Heinemann et al., 2004). The GCS consists of 21 items covering anxiety, depression, somatic, and vasomotor symptoms on a 4-point scale (0–3) (Greene, 1998). Previous studies reported Cronbach's alpha values between 0.85 and 0.91 for both instruments, indicating high reliability (Imarina et al., 2020). Indonesian versions were adapted through back-translation and cultural validation, and copies of the instruments are available in supplementary materials.

Intervention

The intervention followed a standardized preparation protocol. Fifty grams of fresh lemongrass leaves were boiled in 1000 ml of water for 15 minutes, cooled, and filtered. Participants consumed 250 ml once daily for 30 consecutive days, preferably after breakfast. The decoction was verified in a phytochemical laboratory, confirming the presence of flavonoids, alkaloids, and saponins. Safety and adherence were monitored weekly by trained midwives using structured interviews and daily consumption checklists. No adverse events were reported. The dosage was based on previous evidence indicating the safety and hormonal-modulating effects of lemongrass.

Data Collection

Data collection took place from June to August 2025. Trained midwives served as enumerators, administering pre- and post-intervention questionnaires and supervising daily consumption to ensure compliance. Baseline and post-intervention data were gathered using the MRS and GCS instruments. Missing data were managed through listwise deletion, although all participants completed the study.

Data Analysis

All analyses were performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics summarized participant characteristics, while normality was assessed using the Shapiro–Wilk test. Depending on data distribution, paired *t*-tests or Wilcoxon signed-rank tests were used to compare pre-–post-test results within groups, and the Mann–Whitney U test assessed between-group differences. Statistical significance was determined at $p < 0.05$ with 95% confidence intervals reported.

Ethical Considerations

This study adhered to the ethical principles of the Declaration of Helsinki and complied with national research ethics regulations in Indonesia. Ethical approval was obtained from the Institutional Review Board prior to participant recruitment. All participants received verbal and written explanations regarding the study objectives, procedures, potential benefits, and risks before providing written informed consent. Participation

was entirely voluntary, and participants were free to withdraw at any stage without any consequences. Data confidentiality and anonymity were strictly maintained throughout the research process. The intervention involved the administration of a commonly used herbal decoction with no known adverse effects, and participants were monitored closely to ensure safety during the study period.

Results

Thirty women aged 40–45 years participated and completed the study with no dropouts. As shown in **Table 2**, the majority of respondents (93.3%) had higher education levels, while 6.7% had lower education. Most participants (56.7%) were not employed, and 43.3% were working. The average number of children was two, consistent with the reproductive profile of women in the premenopausal age group.

Table 1. Phytochemical test results of Cymbopogon citratus decoction

Plant Type	Plant Part Tested	Solvent	Phytochemical Screening Test Results							
			Alkaloid			Flavonoid	Triterpenoid/steroid	Glikosida	Saponin	Tanin
			Bouchardat	Meyer	Dragendof	MgHCl+ H_2SO_4	Lieberman-Bouchardat	Molish+ H_2SO_4	Aquades	$FeCl_3$
Lemongrass	Leaf		+	+	+	+	+	+	+	+
Honey			-	-	-	=	+	+	-	-

Description: Bouchardat= KI + Aquadest + Iodine; Meyer=HgCl + Aquadest + KI; Lieberman-Bourchat: H2SO4 (p) + CH3COOH

The results of this test strengthen the scientific basis that lemongrass has potential as a non-conventional herbal therapy in preventing premature menopause (**Table 1**)

Table 2. Distribution of Participants by Sociodemographic Characteristics (n = 30)

Characteristics	n	%
Age (years)		
40–42	17	56.7
43–45	13	43.3
Education level		
Higher education (≥ senior high school)	28	93.3
Low education (< senior high school)	2	6.7
Occupation		
Working	13	43.3
Not working	17	56.7
Number of children		
1–2	21	70.0
≥3	9	30.0

Higher education = senior high school or above; low education = below senior high school.

Participant compliance with daily consumption of *Cymbopogon citratus* decoction for 30 days averaged 86.7%. No adverse effects or withdrawals were reported. The intervention was well tolerated, indicating good acceptability in a community-based setting (Figure 1). Menopausal symptoms were assessed using the Menopause Rating Scale (MRS), which includes three domains: (1) psychological (e.g., anxiety, mood swings, sleep disturbances), (2) somatic (e.g., hot flashes, joint pain, fatigue), and (3) urogenital (e.g., vaginal dryness, sexual discomfort). As shown in Table 3, the mean total MRS score in the intervention group decreased significantly from 20.5 ± 2.0 to 13.4 ± 1.6 ($p < 0.001$, 95% CI [5.7, 8.4], $d = 1.45$, large effect). In contrast, the control group showed no significant change. The results indicate a substantial reduction across all symptom domains, confirming the effectiveness of lemongrass decoction in alleviating menopausal complaints (**Table 3** and **Figure 1**).

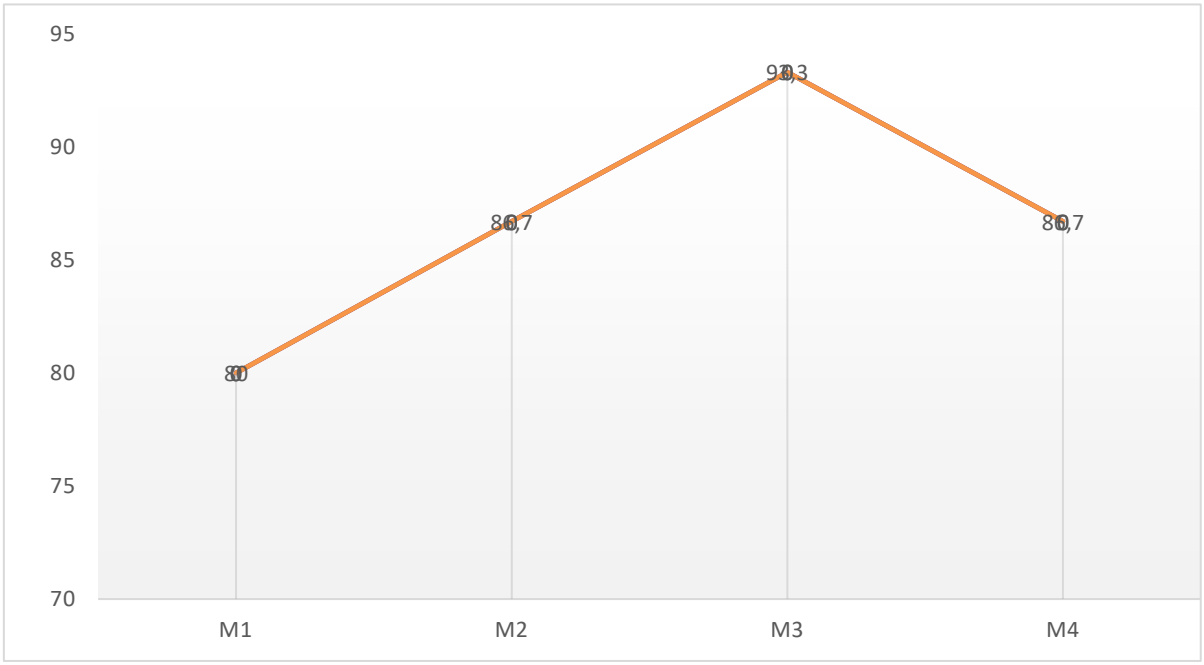

Figure 1. Average Level of Compliance with Lemongrass Decoction Consumption (%) in the Intervention Group

Table 3. Changes in MRS scores pre-, post-intervention

Variable	Intervention (Mean ± SD)	Control (Mean ± SD)	95% CI	*p*-value	Effect size (Cohen's *d*)
Psychological					
Pre Test	7.2 ± 0.88	7.4 ± 0.98	[2.6, 3.2]	< 0.001	1.32
Post Test	4.2 ± 0.77	7.2 ± 0.88			
Somatic	Pre: Post:	Pre: Post:			
Pre Test	8.2 ± 0.60	8.2 ± 0.67	[2.5, 3.1]	< 0.001	1.40
Post Test	5.3 ± 0.48	8.2 ± 0.60			
Urogenital					
Pre Test	5.1 ± 0.60	5.0 ± 0.59	[0.9, 1.4]	< 0.001	1.08
Post Test	3.9 ± 0.35	5.1 ± 0.60			

Note. A decrease in score indicates symptom improvement. MRS = Menopause Rating Scale.

Cycle regularity was used as an indicator of hormonal balance. As presented in **Table 4**, 73.3% of women in the intervention group reported more regular menstrual cycles after 30 days, compared with only 13.3% in the control group. The association between intervention and cycle improvement was statistically significant ($p < 0.001$, χ^2 test).

Table 4. Changes in menstrual cycle regularity after 30 days

Category	Intervention (n=15)		Control (n=15)		Percentage Difference (%)	*p*-value
	n	%	n	%		
More organized	11	73,3	2	13,3	+60.0	< 0.001
Do not change	4	26,7	11	73,4	-	
More irregular	0	0	2	13,3	-	

Note. Regular cycle = 21–35 days with consistent duration over two consecutive months.

The administration of lemongrass decoction for 30 days significantly improved menopausal symptom scores and menstrual cycle regularity compared with the control group ($p < 0.001$). The intervention achieved a large effect size (Cohen's $d = 1.45$), confirming its strong clinical relevance. These results demonstrate that lemongrass decoction is a safe, feasible, and effective non-hormonal option for community-based prevention of early menopause.

Discussion

This study evaluated the effectiveness of *Cymbopogon citratus* (lemongrass) decoction as a non-hormonal complementary therapy to prevent early menopause among women aged 40–45 years in Perbulan Village, Karo Regency. The findings demonstrated significant reductions in menopausal symptom scores and improvements in menstrual cycle regularity in the intervention group compared with controls, indicating that daily consumption of lemongrass decoction can support hormonal balance and alleviate perimenopausal discomfort.

The results are consistent with previous research showing the biological potential of lemongrass in modulating hormonal function. Research by Himawan et al. (2021) showed that lemongrass extract has high antioxidant activity, which plays a key role in reducing oxidative stress—a major factor in ovarian aging. This antioxidant activity comes from its content of bioactive compounds such as flavonoids and phenolics, which can ward off free radicals and protect cells from damage. The present study extends these findings by confirming that a standardized community-based decoction regimen yields measurable benefits in clinical outcomes.

The phytochemical composition of lemongrass, particularly its citral, flavonoids, and phenolic acids, is thought to be the primary biological mechanism underlying its benefits. Citral is the main component of lemongrass essential oil, which has been shown to have various biological activities, including acting as an antioxidant and a central nervous system modulator (Silva et al., 2022). Furthermore, citral acts as a monoterpene that can influence enzyme and receptor activity, although specific evidence regarding indirect stimulation of estrogen synthesis is still limited (E. R. de Oliveira et al., 2018). Flavonoids such as luteolin and apigenin found in lemongrass are known as phytoestrogens, plant compounds capable of binding to estrogen receptors, specifically estrogen receptor beta (ER-β) (J. R. de Oliveira et al., 2019). This interaction has the potential to help regulate the hypothalamic-pituitary-ovarian axis, thereby stabilizing hormonal fluctuations and maintaining menstrual regularity.

These findings are in line with de Oliveira et al. (2019), who demonstrated the estrogenic and antioxidant properties of lemongrass tea in experimental models, and with Mbachu et al. (2020), who found that flavonoid components influence estrogen receptor beta (ER-β) signaling and promote hormonal modulation. Together, these studies support the hypothesis that lemongrass acts as a natural phytohormone source, promoting ovarian health without

the risks associated with conventional hormone replacement therapy (HRT).

In addition to its biological benefits, the intervention's acceptability and safety highlight its potential for integration into rural and community health programs. Compliance rates of 86.7% and the absence of adverse effects suggest that lemongrass decoction is a feasible and culturally compatible approach for women who prefer natural therapies. This aligns with Indonesia's *Healthy Indonesia Program* and the global movement toward sustainable, community-based preventive health care.

Nevertheless, certain limitations should be acknowledged. The sample size was relatively small (n = 30), and the intervention lasted only 30 days, which may limit the generalizability and long-term inference of the findings. Additionally, biochemical markers such as estrogen, FSH, or LH levels were not assessed, preventing confirmation of hormonal changes at the molecular level. Despite these constraints, the randomized design, full participant retention, and consistent monitoring strengthened internal validity and reduced bias. Future research with larger samples, extended follow-up periods, and hormonal assays is recommended to confirm and expand on these preliminary findings.

Implications and limitations

This study provides practical implications for midwifery and public health practice. *Cymbopogon citratus* (lemongrass) decoction proved effective, safe, and acceptable for reducing menopausal symptoms and regulating menstrual cycles. Its integration into midwifery counseling and community reproductive health programs can serve as a non-hormonal, locally available alternative that supports preventive women's health strategies aligned with the *Healthy Indonesia Program* and SDG 3.

At the policy level, promoting standardized herbal education for midwives and community health workers may enhance the safe and evidence-based use of herbal therapies in rural areas.

However, the study was limited by its small sample size, short intervention period, and lack of hormonal biomarker analysis, which restricts generalization. Despite these limitations, the randomized design and full participant retention strengthen the validity of findings, warranting further large-scale and long-term studies.

Relevance to Practice

The findings of this study highlight the potential of *Cymbopogon citratus* (lemongrass) decoction as a safe, affordable, and culturally acceptable complementary therapy for the prevention of early menopause among women aged 40–45 years. Its integration into midwifery and community health practice provides a non-hormonal alternative that can be implemented particularly in rural settings with limited access to conventional therapies.

This intervention not only supports women's reproductive health and quality of life but also emphasizes the importance of incorporating locally available herbal resources into health promotion programs. By empowering women to actively manage menopausal health through simple and practical approaches, the study contributes to reducing the risk of degenerative health problems associated with early menopause and offers a foundation for developing community-based midwifery guidelines.

Conclusion

This study demonstrates that *Cymbopogon citratus* (lemongrass) decoction is effective as a non-hormonal complementary therapy for preventing early menopause in women aged 40–45

years. Daily consumption of 250 ml for 30 consecutive days significantly reduced menopausal symptoms, improved menstrual cycle regularity, and showed high adherence without adverse effects. These findings suggest that lemongrass decoction is a safe, affordable, and culturally acceptable intervention that may be integrated into midwifery and community health practice to promote women's reproductive health and quality of life.

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CrediT Authorship Contributions Statement

Mediana Beru Sembiring: Conceptualization, Methodology, Supervision

Lasria Simamora: Software, Validation, Formal Analysis, Writing - Review & Editing

Dewi Sartika Hutabarat: Investigation, Resources, Data Curation, Project Administration

Polma Ria Metawati Panjaitan: Writing - Original Draft, Review & Editing

Imarina Tarigan: Writing - Original Draft, Visualization, Funding Acquisition

Rika Khairatun Nisa: Conducting laboratory tests to identify the content of lemongrass.

Ratu Putri Arjuna: Documenting research activities and assisting in the preparation of required equipment.

Conflicts of Interest

There is no conflict of interest.

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