



Effectiveness of Citronella oil aromatherapy in enhancing appetite among stunted toddlers

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ARTICLE INFO	ABSTRACT
<p><i>Article history:</i> Received : 10 October 2024 Accepted : 02 January 2025 Published : 28 February 2025</p> <p><i>Keywords:</i> Stunted toddlers Citronella oil Aromatherapy Appetite enhancement Nutritional intervention</p>	<p><i>Background:</i> Stunting is a major public health concern, affecting millions of children worldwide, particularly in Indonesia, where 27.7% of children under five are affected. Poor appetite is a common issue among stunted children, contributing to malnutrition. <i>Citronella</i> oil, known for its appetite-stimulating properties, offers a potential intervention.</p> <p><i>Objective:</i> To measure the effect of citronella oil aromatherapy on appetite in stunted toddlers.</p> <p><i>Method:</i> A one-group pretest-posttest design was employed, involving 33 stunted toddler and parents at Long Kali Community Health Center. Appetite was assessed using the Child Eating Behavior Questionnaire (CEBQ) before and after exposure to citronella oil. Paired t-tests were used to analyze the data, with significance set at $p < 0.05$.</p> <p><i>Result:</i> The results showed a significant improvement in appetite after the intervention, with the mean CEBQ score increasing from 23.76 to 60.45 ($p < 0.001$). Prior to the intervention, 81.8% of toddlers exhibited poor appetite, but post-intervention, 81.8% demonstrated good appetite. These findings suggest that Citronella oil aromatherapy is an effective method for stimulating appetite in stunted toddlers. The aroma activates the olfactory system, positively influencing the brain's limbic system, which regulates appetite and emotions.</p> <p><i>Conclusion:</i> The statistically significant improvements highlight the potential for integrating Citronella oil into nutritional interventions for stunted children, particularly in resource-limited settings. This study contributes to the growing body of evidence supporting the use of aromatherapy as a complementary approach to addressing malnutrition and poor appetite in pediatric populations.</p>

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1. Introduction

Stunting is a global public health issue that affects millions of children worldwide, particularly in low- and middle-income countries. Stunting is defined as impaired growth and



development caused by poor nutrition, repeated infections, and inadequate psychosocial stimulation, often manifesting as height-for-age below the standard. It is an indicator of chronic malnutrition and is associated with long-term effects on cognitive development, educational attainment, and economic productivity in adulthood (WHO-UNICEF-World Bank Group, 2023). Globally, stunting affects approximately 22% of children under the age of five, which translates to about 149.2 million children (UNICEF, 2020). In Indonesia, the prevalence of stunting remains alarmingly high, with around 27.7% of children affected in 2021 (Indonesian Ministry of Health, 2021; Indonesian Ministry of Health-UNICEF, 2021). Among the multiple complications that arise from stunting, poor appetite is a prominent issue that exacerbates nutritional deficiencies in children, creating a vicious cycle of malnutrition.

Children with stunting often present with a marked reduction in appetite, making it difficult for them to consume adequate nutrients necessary for their growth and development. Studies have shown that a lack of appetite is prevalent among 33.6% of stunted children, contributing to insufficient food intake and further nutritional decline (Khadija et al., 2022; Vaivada et al., 2020). Malnourished children, including those with mild to moderate malnutrition, often have a reduced desire to eat, which severely limits their intake of essential nutrients. In fact, approximately 44.5% of children who experience reduced appetite are classified as suffering from mild to moderate malnutrition (Das et al., 2020; Dipasquale et al., 2020; Govender et al., 2021). Moreover, an alarming 79.2% of children with poor appetite are at a heightened risk of long-term health complications, including compromised immune function and impaired physical and mental development (Amoah et al., 2024). The challenge of increasing appetite in these children, especially those with stunting, has thus become a priority in public health interventions.

Several interventions have been proposed to address the issue of poor appetite in stunted children, ranging from nutritional supplements to behavioral interventions. However, the success of these interventions has been limited, particularly in resource-constrained settings. Given the cultural preference for natural and herbal remedies in many regions, aromatherapy has emerged as a potential solution to improve appetite in stunted children. Aromatherapy is the practice of using essential oils to promote physical and psychological well-being. It has been widely used in traditional medicine to stimulate appetite, reduce stress, and improve mood (Brennan et al., 2022; Mukti, 2024; Vora et al., 2024). Among the



various essential oils, citronella oil has gained attention due to its potent bioactive compounds, particularly citronellal and geraniol, which are known for their therapeutic properties (Iovinella et al., 2022; Mukarram et al., 2021).

Citronella (*Cymbopogon nardus*) oil is extracted from the leaves and stems and has been traditionally used in many cultures as an postpartum therapy, insect repellent, antifungal agent, and appetite stimulant (Iovinella et al., 2022; Meidawati et al., 2024; Mukarram et al., 2021; Vora et al., 2024). Citronellal, the primary component of citronella oil, has been shown to have both antimicrobial and anti-inflammatory effects, while geraniol, another major component, exhibits antioxidant and appetite-enhancing properties (Nguyen et al., 2023). Aromatherapy with citronella oil is believed to activate the olfactory system, which is closely linked to the limbic system of the brain, responsible for regulating emotions and appetite (Agarwal et al., 2022; Fung et al., 2021). The pleasant aroma of citronella oil can help reduce anxiety and stimulate the desire to eat by triggering a positive emotional response in children.

Despite the potential benefits of citronella oil, there remains a significant gap in the scientific literature regarding its effectiveness in improving appetite among stunted children. Most existing studies have focused on the general population or adults, with few exploring the specific application of aromatherapy in pediatric populations, particularly those suffering from malnutrition and stunting. Furthermore, while the use of essential oils for appetite enhancement is gaining popularity, robust scientific evidence supporting their efficacy in improving nutritional outcomes in stunted children is still limited. This gap underscores the need for research focusing on the effects of citronella oil aromatherapy on stunted toddlers, particularly in rural health care settings where access to conventional appetite stimulants and nutritional therapies may be limited.

Addressing the issue of stunting and poor appetite in children is particularly critical in Indonesia, where the national stunting reduction program emphasizes the importance of improving children's nutritional status through both medical and community-based interventions (Indonesian Ministry of Health-UNICEF, 2021). The Long Kali Community Health Center, located in a rural area of Paser Regency, East Kalimantan, is one such facility where stunted children are routinely monitored and treated. However, despite the availability of health services, many children continue to suffer from poor appetite, which hinders their recovery from stunting. Given the cultural acceptance of herbal remedies in this region,



aromatherapy using citronella oil offers a promising, low-cost intervention that could complement existing nutritional programs. This study aims to determine the effect of giving citronella oil aromatherapy on appetite in stunted toddlers.

2. Method

Research design

This study employed a quantitative research approach using a pre-experimental design with a one-group pretest-posttest design. In this design, the stunted toddlers were observed before and after the intervention to determine the effect of citronella oil aromatherapy on their appetite. The pre-experimental design lacks a control group, which makes it a useful approach for preliminary studies in real-world settings, especially in health-related interventions where the primary objective is to evaluate the initial effectiveness of a treatment (Miller et al., 2020). The study was conducted in the Long Kali Community Health Center, Paser Regency, Indonesia, an area with a notable prevalence of stunting among children.

Respondent

The sample size was determined using a total sampling technique, resulting in 33 toddlers being selected for the study. The inclusion criteria for the sample were toddlers diagnosed with stunting and having malnutrition as well as poor appetite. Stunting and nutritional status were assessed based on WHO standards (Indonesian Ministry of Health-UNICEF, 2021). Toddlers whose parents did not consent to participate or had pre-existing conditions that might affect appetite, such as gastrointestinal diseases, were excluded.

Data collection

The primary data collection instrument used in this study was the Child Eating Behavior Questionnaire (CEBQ), a validated tool for assessing children's eating behaviors, including appetite (Wardle et al., 2001). The questionnaire was administered to parents to gather information on the toddlers' eating habits and appetite before and after the intervention. The data collection process was conducted in three stages: preparation, implementation, and finalization. In the preparation stage, parents were briefed about the study, and informed consent was obtained. During the implementation stage, the toddlers were exposed to citronella oil aromatherapy, and their appetite was measured using the CEBQ before and after



the intervention. In the final stage, data were compiled and prepared for analysis.

The use of citronella oil was based on its known bioactive compounds, citronellal and geraniol, which have appetite-stimulating effects (Nguyen et al., 2023). Aromatherapy sessions were conducted in a controlled environment within the community health center, where the toddlers were exposed to citronella oil for a prescribed duration based on previous studies suggesting its efficacy in enhancing appetite.

Data Analysis

Paired t-tests were employed to compare the mean appetite scores pre- and post-therapy and to evaluate whether the observed changes were statistically significant. The paired t-test is an appropriate method for analyzing changes in continuous outcomes in the same group over time (Najmi et al., 2021). The significance level for all analyses was set at $p < 0.05$. The statistical analysis was performed using SPSS software version 26.

Ethical consideration

This study adhered to ethical guidelines for research involving human subjects. Ethical approval was obtained register number 103/KEP-UNISM/II/2024 from the Ethics Committee of Sari Mulia University, ensuring that the study complied with international ethical standards. Informed consent was obtained from the parents or legal guardians of the toddlers prior to participation. The research team ensured that the study posed no harm to the participants, and all data were kept confidential. Participants were given the freedom to withdraw from the study at any stage without any consequences. This process aligns with ethical standards outlined in the Declaration of Helsinki (World Medical Association, 2013).

3. Results

Respondent characteristics

This study involved 33 respondents, mothers of stunted toddlers, aged between 20 and 45 years, as shown in Table 1. The majority of respondents were in the 26-30 age group (42.4%), with most having completed junior high school or an equivalent level of education (54.5%). This indicates that younger mothers with middle-level education are predominant in this study, which may be linked to the higher prevalence of stunting in families with lower socioeconomic status.



Table 1. Characteristics of respondents

Characteristics	Frequency (respondent)	Percentage (%)
Ages (year)		
20-25	2	6.1
26-30	14	42.4
31-35	9	27.3
36-40	6	18.2
41-45	2	6.1
Education levels		
Elementary school	9	27.3
Junior High School	18	54.5
Senior High School	6	18.2

Stunted toddlers appetite

As showed in Table 2, the measurement of toddlers' appetite before and after the intervention shows a significant improvement. Prior to the intervention, most toddlers (81.8%) had poor appetite, and none were categorized as having a good appetite. Following the intervention with Citronella oil aromatherapy, 81.8% of toddlers improved to having good appetite, while the proportion of toddlers with sufficient appetite remained unchanged at 18.2%. These results indicate a clear positive effect of the aromatherapy intervention on improving the appetite of stunted toddlers.

Table 2. Frequency distribution of appetiet in stunted toddler

Categories	Pre-intervention		Post-intervention	
	Frequencies	Percentages	Frequencies	Percentages
Good	0	0	27	81.8
Sufficient	6	18.2	6	18.2
Poor	27	81.8	0	0
Total	33	100	33	100

Effect of *Cintronella* oil aromatherapy on appetite

Table 3 demonstrates the significant effect of *Cintronella* oil aromatherapy on increasing appetite. The average appetite score of toddlers before the intervention was 23.76, which increased to 60.45 after the intervention. The p-value of <0.001 suggests that this difference is statistically significant. This finding highlights that Citronella oil aromatherapy is an effective method to enhance appetite in stunted toddlers, particularly those struggling with poor appetite due to stunting.


Table 3. Effect of *Citronella* oil aromatherapy on CEBQ scores

CEBQ scores	Mean \pm SD	MD \pm SD	p-value*
Pre-therapy	23.76 \pm 4.61	36.697 \pm 7.88	<0.001
Post-therapy	60.45 \pm 3.649		

Notes: SD is standard deviation; MD is mean difference; * is T-test.

4. Discussions

The findings demonstrated a significant improvement in appetite scores post-intervention, supporting the hypothesis that *Citronella* oil can be an effective means of enhancing appetite in this vulnerable population. The results also align with previous studies on the use of aromatherapy in pediatric care, particularly for appetite stimulation (Conlon et al., 2017; Farrar & Farrar, 2020; Sánchez et al., 2022).

The demographic characteristics of the respondents (Table 1) highlight that most participants were young mothers between 26 and 30 years of age, and more than half had only completed junior high school. These findings underscore the close relationship between lower socioeconomic status and the prevalence of stunting, which has been well-documented in the literature (Bommer et al., 2019; Widyaningsih et al., 2022). Stunting is often associated with poor maternal education and limited access to health information, which can negatively influence child nutrition (De Sanctis et al., 2021; Laksono et al., 2022). Younger mothers with less formal education may lack knowledge about proper child nutrition, contributing to the high rates of stunting in their children. This association is crucial as it emphasizes the importance of targeted interventions not only for the children but also for educating parents on nutrition and health care.

The significant improvement in toddlers' appetite post-intervention, as presented in Table 2, is a key finding. Prior to the intervention, 81.8% of the children had poor appetite, with none categorized as having good appetite. Post-intervention, this figure was reversed, with 81.8% of the children demonstrating good appetite, while none were categorized as having poor appetite. These results strongly indicate the effectiveness of *Citronella* oil in stimulating appetite, aligning with existing literature that supports the role of aromatherapy in enhancing feeding behavior (Forde & de Graaf, 2022; Sowndhararajan & Kim, 2016). Aromatherapy, particularly using essential oils, has been shown to impact the central nervous system through olfactory stimulation, which can enhance mood, reduce anxiety, and promote relaxation, ultimately improving appetite (Lv et al., 2013). In the case of stunted toddlers, the



calming effects of *Citronella* oil may have contributed to reduced stress levels, which often interfere with hunger cues (De Sanctis et al., 2021; Sayowan et al., 2012).

Furthermore, the increase in mean appetite scores from 23.76 to 60.45, as shown in Table 3, highlights a statistically significant improvement in the children's eating behavior. This result is supported by a p-value of less than 0.001, confirming the effectiveness of the intervention. Studies on essential oils have demonstrated that olfactory stimulation can positively affect both physiological and psychological aspects of health, leading to improved appetite (Sattayakhom et al., 2023; Vora et al., 2024). The mechanisms by which *Citronella* oil enhances appetite likely involve its ability to modulate the release of neurotransmitters such as serotonin and dopamine, which are known to regulate mood and hunger (Gasmi et al., 2022; Yoo et al., 2021).

It is important to note that the effectiveness of *Citronella* oil in this study aligns with the broader literature on the use of aromatherapy in pediatric populations. Previous studies have found that essential oils, such as lavender and peppermint, can reduce anxiety and improve digestive function, both of which are critical for appetite regulation (Donelli et al., 2019; Fung et al., 2021; Lizarraga-Valderrama, 2021; Malcolm & Tallian, 2017; Tan et al., 2023). The present study contributes to this body of knowledge by demonstrating that *Citronella* oil, though less commonly studied for appetite stimulation, can be equally effective in improving feeding behavior in stunted toddlers.

However, several limitations should be acknowledged. First, the relatively small sample size (33 participants) limits the generalizability of the findings. Although the results are statistically significant, larger studies are needed to confirm the efficacy of *Citronella* oil aromatherapy in diverse populations and settings. Additionally, the study did not account for other variables that may influence appetite, such as concurrent medical conditions, medications, or psychological factors affecting the children. Future research should aim to control for these confounding factors to provide a clearer understanding of the specific role of *Citronella* oil in appetite stimulation.

Moreover, while the short-term effects of the intervention are promising, the long-term sustainability of improved appetite remains uncertain. The study only measured appetite immediately after the intervention, and it is unclear whether the effects of *Citronella* oil would



persist over time without continuous application. Longitudinal studies that follow children over extended periods are necessary to assess whether the appetite improvements seen in this study can be maintained and whether *Citronella* oil could be integrated into long-term treatment plans for stunted children.

Another consideration is the potential for individual variability in response to aromatherapy. Although the majority of children in this study responded positively to the intervention, the unchanged proportion of toddlers with sufficient appetite suggests that some children may not experience the same level of benefit from *Citronella* oil. This could be due to genetic factors, pre-existing health conditions, or environmental influences (Virolainen et al., 2022). Future studies should investigate these differences to better understand which children are most likely to benefit from aromatherapy interventions.

Despite these limitations, the findings of this study have important implications for public health and clinical practice. *Citronella* oil aromatherapy offers a non-invasive, low-cost intervention that could be used to improve appetite in stunted toddlers, especially in low-resource settings where access to conventional treatments may be limited. Incorporating this therapy into broader public health strategies, including nutritional education for parents and caregivers, could significantly enhance the effectiveness of stunting interventions.

5. Conclusion

This study provides compelling evidence that Citronella oil aromatherapy can effectively stimulate appetite in stunted toddlers, as demonstrated by significant improvements in appetite scores. While further research is needed to confirm these findings and explore their long-term implications, the use of Citronella oil as an adjunctive therapy for stunting holds considerable promise. By addressing both the psychological and physiological aspects of appetite regulation, Citronella oil could play a vital role in improving the nutritional status of children suffering from stunting.

6. Conflict of interest

All authors declare no conflict of interest.



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