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The effectiveness of katuk leaf cookies on prolactin hormone levels and breast milk production in lactating mothers

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Abstract

Breast milk is the best source of nutrition for infants, providing essential nutrients tailored to support their growth and development. However, many breastfeeding mothers report insufficient milk production. One non-pharmacological approach to address this issue is the utilization of traditional ingredients, such as Sauropus and rogynus (katuk leaves), which are processed into cookies to enhance ease of consumption. This study aimed to examine the effectiveness of katuk leaf cookies in increasing prolactin levels and breast milk output in postpartum mothers. This research employed a quasi-experimental design. A total of 42 postpartum mothers in the maternity ward of Aji Batara Agung Dewa Sakti Hospital, Samboja, were selected using purposive sampling and divided into two groups. The intervention group (n = 21) received katuk leaf cookies (200 grams, twice daily), while the control group (n = 21) received no intervention. Data were collected through observation and analyzed using paired t-test and independent t-test. There was a statistically significant increase in prolactin hormone levels and breast milk volume in the intervention group compared to the control group (p = 0.000). The average prolactin level increased from 117.89 to 258.48 ng/mL, while breast milk volume increased from 26.07 to 572.57 mL. In contrast, the control group showed a much smaller increase in both parameters. The administration of katuk leaf cookies effectively enhanced prolactin hormone levels and breast milk production among postpartum mothers. The result supports the potential of katuk leaves as a functional food intervention in lactation support. Katuk leaf cookies can be used as a non-pharmacological intervention to increase prolactin hormone levels and breast milk production in lactating mothers.

Keywords: Katuk leaf cookies, Prolactin, Breast milk production

Introduction

Exclusive breastfeeding during the first six months of life is strongly recommended by the World Health Organization (WHO) due to its extensive benefits for infant growth, immune function, and prevention of chronic diseases. However, despite these advantages, many countries—including Indonesia—have yet to achieve optimal rates of exclusive breastfeeding, largely due to inadequate breast milk production. According to the 2020 Indonesian Health Profile, the national rate of exclusive breastfeeding coverage at the provincial level was 66.1%, with East Kalimantan reaching 68.11%. In contrast, the coverage in Kutai Kartanegara Regency in 2023 was only 47.5%, and alarmingly, the rate at Aji Batara Agung Dewa Sakti Regional Hospital (RSUD Samboja) was just 5.48% in the same year. These figures highlight the urgent need for enhanced efforts to promote exclusive breastfeeding, given its vital health benefits for both mothers and infants.

One of the primary factors regulating breast milk production is the hormone prolactin, which is influenced by various determinants including maternal nutritional status, postpartum stress, and the intake of foods known as galactagogues. Indonesia is rich in traditional herbal remedies that have been empirically used as lactation enhancers. One such widely studied galactagogue is *Sauropus androgynus* (katuk leaves). Previous research has shown that katuk leaf extract, whether used alone or in combination with other plants, significantly increases the expression of prolactin in the mammary glands, thereby stimulating breast milk production (Intan et al., 2024).

Katuk leaves are known to contain phytochemicals such as alkaloids, sterols, vitamins, and minerals, which are believed to play a role in enhancing lactation (Ammar et al., 2025). Other commonly used traditional galactagogues include *Coleus amboinicus* (torbangun) and papaya leaves. A clinical

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trial evaluating the efficacy and safety of a polyherbal galactagogue formulation—composed of katuk, torbangun, and papaya leaves—compared with a commercial capsule containing a single extract of katuk found that both interventions were equally effective and safe when used for 14 days (Zulkarnain et al., 2024). Thus, the use of natural galactagogues offers a promising alternative in improving milk production among breastfeeding mothers.

A study by Herawati & Nursitiyaroh (2023) confirmed that mothers who consumed katuk leaves produced more breast milk than they did prior to the intervention. Other studies suggest that both pharmacological and natural galactagogues may enhance milk volume; however, the current body of evidence remains inconsistent and inconclusive. The effects on infant weight gain and breastfeeding sustainability are not well-established. Given the high risk of bias and heterogeneity in previous studies, further research with stronger methodologies is needed to validate the efficacy and safety of each galactagogue (Foong et al., 2020). Among mothers of preterm infants in neonatal intensive care units, the consumption of herbal galactagogue teas has been shown to improve lactation and prevent milk insufficiency without adverse effects (Lunn et al., 1980; Özalkaya et al., 2018). The use of food-based galactagogues is widespread across various communities, with preferences often influenced by cultural and ethnic backgrounds. Therefore, future studies should focus more closely on the efficacy and safety of galactagogues in practical application (Bibi et al., 2021).

Currently, there is limited research utilizing innovative products such as ready-to-eat galactagogue-based foods like cookies, particularly those that assess objective outcomes such as changes in prolactin hormone levels rather than relying solely on subjective maternal reports. Furthermore, international studies that integrate food-based interventions with hormonal measurements are still scarce. Hence, this study aims to evaluate the effectiveness of katuk leaf cookies on prolactin hormone levels and breast milk production in lactating mothers at RSUD Aji Batara Agung Dewa Sakti Samboja in 2024.

Phytochemically, tamarind leaves are known to contain flavonoids and tannins, as well as other compounds such as lupeol, saponins, and steroids [21]. Flavonoids and tannins in tamarind leaves damage bacterial cell membranes, increase cell wall permeability, and inhibit enzyme activity, suppressing the inflammatory process and accelerating the formation of new tissue. Tamarind leaf extract has also increased the migration and proliferation of fibroblasts, which are very important in wound healing. This mechanism is also supported by the antioxidant and anti-inflammatory activities of these bioactive compounds, which can stimulate the production of cytokines and growth factors that play a role in tissue regeneration [22]. This study aims to test the effectiveness of administering ethanol extract of tamarind leaves (Tamarindus indica L.) on the wound healing process in female white rats (Rattus norvegicus).

Research Methods

Research design and location

This study used an experimental research method with a quasi-experimental design: "Two group pre and post-test design with control group." There was one experimental group and one control group, in which prolactin levels and breast milk output were measured before and after the intervention (Anshori & Sri Iswati, 2020). The research was conducted in the postpartum ward of RSUD Aji Batara Agung Dewa Sakti Samboja, Kutai Kartanegara Regency, in March 2025.

Population and sample

The population in this study consisted of postpartum mothers in the postpartum ward of RSUD Aji Batara Agung Dewa Sakti Samboja, who also served as the research sample using consecutive sampling technique (Riyanto & Putera, 2022). Based on calculations, the sample size was 21 participants for the experimental group and 21 for the control group, totaling 42 participants who met the inclusion criteria, which included willingness to participate, postpartum mothers with normal delivery, full consciousness, good health, and no post-delivery complications. Exclusion criteria were mothers with delivery complications such as hemorrhage, mothers who had stillbirths, mothers receiving hormone therapy (estrogen and progesterone), mothers with nipple abnormalities, mothers experiencing

psychological depression (postpartum blues), babies born with low birth weight, sick babies or babies with abnormalities, and babies born with congenital defects.

Data analysis

Univariate analysis was used to describe prolactin levels in primiparous and multiparous postpartum mothers. Bivariate analysis was performed to examine the effect of giving katuk leaf cookies before and after intervention in both experimental and control groups using the paired t-test if data were normally distributed; if not, the Wilcoxon test was used. To compare prolactin levels and breast milk output between the experimental and control groups, the independent t-test was used for normally distributed data; otherwise, the Mann-Whitney test was applied (Sugiyono, 2017). Organoleptic testing was conducted to determine the preference level for the product. This test used a hedonic scale describing the sample such as: like very much, like, somewhat like, somewhat dislike, dislike, and dislike very much.

Ethics and research procedure

This study received ethical approval from the Faculty of Public Health, Hasanuddin University, with approval number: 160/UN4.14.1/TP.01.02/2025. Before conducting the research procedures, the researchers provided informed consent forms to postpartum mothers along with explanations and guarantees of data confidentiality and participant rights. Prolactin examination was performed by collecting blood samples from the median cubital vein of postpartum mothers according to standardized procedures and conducted by competent enumerators; the tests were declared valid and reliable. Blood sampling was done between 7 and 9 AM, adjusted for the diurnal variation of prolactin hormone. Samples were stored at 2–8^{0}C before analysis using VIDAS at the clinical pathology laboratory of RSUD Aji Batara Agung Dewa Sakti Samboja. Before the patients returned home, the researchers provided katuk leaf cookies to be consumed for 7 days. The katuk leaf cookies were consumed at 10 pieces per serving, containing 200 grams of katuk leaves, taken twice daily. Prolactin levels and breast milk output were evaluated on the 8th day after the intervention, measured at 6:00 AM.

Results

In this study, to determine the effect of katuk leaf cookies on prolactin hormone levels and breast milk volume in breastfeeding mothers, a comparative analysis was conducted between conditions before and after the intervention. Bivariate analysis was performed to examine the differences in prolactin levels and breast milk output before and after the intervention, which are presented as follows:

Table 1. Effectiveness of the Difference in Prolactin Hormone Levels in Breastfeeding Mothers in the Experimental Group (given katuk leaf cookies) and the Control Group (without katuk leaf cookies) at RSUD Aji Batara Agung Dewa Sakti Samboja, Kutai Kartanegara Regency, 2024

Variable	Measurement	Mean (SD)	Mean Difference (SD)	*P value*
Prolactin Level	Experimental Group Prolactin Level	258.481(53,4369)	82.3714 (13,8290)	0.000
	Control Group Prolactin Level	176.110 (34.0668)		

Source: Data processing results 2024

Based on the analysis results in the table above, it can be seen that the difference in prolactin levels is 82.3714. This value indicates that the group given katuk leaf cookies had higher prolactin levels compared to the group that did not receive katuk leaf cookies by 82.3714.

The independent t-test resulted in a p-value of 0.000 < 0.005, so it can be concluded that there is a significant difference in prolactin hormone levels in breastfeeding mothers before and after in the experimental group (given katuk leaf cookies) and the control group (without katuk leaf cookies) at RSUD Aji Batara Agung Dewa Sakti Samboja, Kutai Kartanegara Regency, in 2024.

Table 2. Effectiveness of the difference in breast milk output in breastfeeding mothers in the experimental group (given katuk leaf cookies) and the control group (without katuk leaf cookies) at RSUD Aji batara agung dewa sakti samboja, kutai kartanegara regency, 2024

Variable	Measurement	Mean (SD)	Mean Difference (SD)	*P value*
Breast Milk Output	Experimental Group Breast Milk Output	572.567 (260.7297)	254.7667 (60.8253)	0.000
	Control Group Breast Milk Output	317.800 (98.5606)		

Source: Data processing results 2024

Based on the analysis results in the table above, it can be seen that the difference in breast milk output is 254.7667. This value indicates that the group given katuk leaf cookies had a higher breast milk output compared to the group that did not receive katuk leaf cookies by 254.7667. The independent t-test yielded a p-value of 0.000, which is less than 0.005, so it can be concluded that there is a significant difference in breast milk output before and after the intervention between the experimental group (given katuk leaf cookies) and the control group (without katuk leaf cookies) at RSUD Aji Batara Agung Dewa Sakti Samboja, Kutai Kartanegara Regency in 2024.

Discussion

Changes in prolactin hormone levels in breastfeeding mothers

The results showed that both the experimental and control groups experienced an increase in prolactin hormone levels postpartum. However, the increase in prolactin levels in the group given katuk leaf cookies was significantly greater than in the control group. This increase indicates that consuming cookies made from katuk leaves (*Sauropus androgynus*) is effective in stimulating prolactin hormone secretion. Active compounds such as alkaloids, flavonoids, and sterols in katuk leaves have been proven to act as lactagogues (substances that stimulate breast milk production) by triggering the release of Prolactin Releasing Factor (PRF) in the hypothalamus, thereby increasing prolactin secretion from the anterior pituitary gland.

Previous studies mention that katuk leaves contain high levels of flavonoids, non-narcotic alkaloids such as papaverine, and sterols such as phytosterol and β-sitosterol. Papaverine has been reported to increase prolactin and oxytocin in animal studies (Anju et al., 2022). In lactating rats, administration of a mixture of katuk, moringa, and coleus extracts increased prolactin expression in mammary glands (via immunohistochemistry), indicating that katuk and other herbal compounds contribute to increased breast milk production and possibly related hormones (Wati et al., 2023).

Physiologically, prolactin is the primary hormone regulating milk production, and its release reflex is highly influenced by the baby's suckling, breastfeeding frequency, and the mother's psychological condition. In this study, most respondents did not experience stress or depression, which is important because stress can trigger Prolactin Inhibitory Factor (PIF) that inhibits prolactin production. Other findings highlight the importance of maternal emotional health during the perinatal period and the influence of infant temperament on breastfeeding outcomes. Interventions to support breastfeeding should include psychological support for mothers and consider infant behavioral characteristics. A more holistic and personalized approach can improve breastfeeding success and align maternal intentions with breastfeeding experiences (Vargas-Pérez et al., 2025). That lead exposure can reduce serum prolactin levels in breastfeeding mothers. Among various maternal and infant factors studied, breastfeeding frequency had a greater influence on prolactin levels than protein or calcium intake. Policymakers should design specific interventions and management strategies for breastfeeding mothers exposed to lead to support optimal milk production (Foong et al., 2020).

It is important to note that although the control group did not receive katuk leaf cookie intervention, they still experienced an increase in prolactin, which can

be explained by factors such as breastfeeding frequency > 8 times/day, strong infant suckling, good maternal nutritional status, and parity (mostly multiparous mothers) who likely have prior breastfeeding experience. This aligns with previous studies showing that breastfeeding duration ≥ 6 months is influenced by older maternal age, higher education, planned pregnancy, non-smoking, body mass index, lower anxiety levels, and ethnic factors (Haas et al., 2022). Younger mothers or those in the active reproductive age range (including 20–35 years) with previous breastfeeding experience tend to maintain exclusive breastfeeding longer, especially with early initiation (Syahri et al., 2024). That good nutritional status and adequate nutrition are associated with more stable serum prolactin levels, which are crucial for optimal milk production (Okinarum et al., 2021).

Breast milk output in breastfeeding mothers given katuk leaf cookies

Breast milk production and output increased significantly in the group consuming katuk leaf cookies over 7 days, indicating the high effectiveness of katuk leaf cookies as a nutritional lactagogic intervention. Physiologically, the early postpartum period involves a drastic decline in progesterone and estrogen levels due to placental delivery, triggering large-scale milk production. This hormonal change combined with katuk leaf consumption enhances stimulation of breast alveoli to produce and release more milk. Another study that prepared katuk leaves as clear vegetable soup reported that consuming katuk leaf soup significantly increases milk production in breastfeeding mothers. Katuk leaves, whether consumed as vegetables or supplements, have the potential as a nutritional intervention to support the success of exclusive breastfeeding in Indonesia (Handayani et al., 2022). The effectiveness of katuk leaves in stimulating milk output is also related to their phytosterol content, which mimics estrogen hormones, as well as vitamins A, B1, C, and saponins that improve metabolic functions supporting lactation. Another study showed that polyherbal formulas can induce galactagogue activity during lactation by upregulating α-lactalbumin and aquaporin gene expression at the messenger RNA level (Mustofa et al., 2020).

Previous research reported that nearly one-third (29%) of breastfeeding mothers experience low milk production within 1–6 months postpartum, with most cases unexplained by medical factors. Although low production is often linked to increased formula use and lower infant weight, many mothers are unaware or do not receive adequate explanations from healthcare providers. This highlights the need for personalized lactation support and improved clinical understanding to address multifactorial milk production issues (Manshanden et al., 2025).

Breast milk output in breastfeeding mothers without katuk leaf cookie administration

Results showed that the control group also experienced an increase in milk output over 7 days. Although the increase was lower than in the experimental group, it was still statistically and physiologically significant. Milk output naturally occurs through lactogenesis II and III mechanisms. Lactogenesis II is triggered by progesterone decline after birth and supported by sufficient prolactin and cortisol levels. This process can be disrupted by birth stress, uncontrolled diabetes, or delayed colostrum removal (Neville & Morton, 2001). Factors supporting milk output in this group include multiparous status, good maternal nutrition, correct breastfeeding techniques, breastfeeding frequency > 8 times/day, strong infant suckling, and absence of psychological stress.

Physiologically, nipple stimulation by infant suckling activates the neuroendocrine pathway from the hypothalamus to the anterior pituitary, triggering prolactin and oxytocin release. Oxytocin induces the let-down reflex, contracting myoepithelial cells around alveoli to push milk through lactiferous ducts. Previous studies showed that katuk leaf extract (*Sauropus androgynus*) significantly increased prolactin and oxytocin gene expression in the brains of lactating rats. Extracts from mature katuk leaves had the most significant increases: 15.75-fold for prolactin and 25.77-fold for oxytocin compared to controls. This effect is believed related to papaverine content, detected only in mature leaves. These findings support katuk leaf's potential as a galactagogue agent via hormonal mechanisms (Soka et al., 2010).

Research also supports that non-nutritional interventions such as breastfeeding education, stress

management, and proper breastfeeding techniques can improve milk production even without herbal or supplemental administration. This aligns with the self-fulfilling prophecy concept emphasizing the importance of positive expectations and confidence from mothers and healthcare providers in influencing breastfeeding motivation and behavior, thereby supporting psychosocial lactation success (Geru et al., 2023). Educational interventions have been proven effective in increasing exclusive breastfeeding practices in mothers with premature infants by enhancing confidence, social support, and positive perceptions of breastfeeding, fostering sustainable behavioral changes (Okhovat et al., 2024).

Effectiveness of differences in prolactin hormone levels and breast milk output between experimental and control groups

Overall, this study demonstrates that the administration of katuk leaf cookies is significantly more effective in increasing prolactin hormone levels and breast milk volume compared to the control group. The average difference in prolactin levels between the experimental and control groups was 82.37 ng/mL. The average difference in breast milk output was 254.77 mL, which is statistically and clinically significant. The phytochemical content of katuk leaves, such as flavonoids, polyphenols, sterols, and alkaloids, works synergistically to stimulate the prolactin and oxytocin reflexes, accelerating the onset and volume of milk production. Furthermore, this effect is reinforced by the respondents' generally stable psychological condition and low stress levels.

This finding is consistent with research examining the effects of consuming cassava leaf jerky (*Manihot esculenta*) on prolactin levels and breast milk production in lactating mothers. The results showed a significant increase in prolactin levels and milk volume in the intervention group compared to the control group (Wulandari et al., 2023). Previous studies have shown that katuk leaf consumption significantly improves the adequacy of breast milk production, particularly in multiparous mothers aged 20–35 years. Frequent breastfeeding also contributes to increased milk production. The alkaloid, sterol, and nutrient content in katuk leaves plays an important role in its effectiveness as a natural lactation enhancer. This supports the use of katuk leaves in maternal health programs to improve breastfeeding success and infant nutritional status (Nurfitri & Prawitasari, 2025).

Similar supporting research indicates that administration of katuk leaves significantly improves breast milk adequacy in nursing mothers. Analysis results showed an increase in the average breast milk adequacy score from 6.80 to 8.47 after katuk leaf administration, with a statistically significant difference. These findings support the potential of katuk leaves as an effective non-nutritional intervention to enhance breast milk production, even without the addition of herbal supplements or other supplements (Suyanti & Anggraeni, 2020).

Conclusion

The administration of cookies made from katuk leaves (*Sauropus androgynus*) significantly increased prolactin hormone levels and breast milk volume in lactating mothers compared to the control group. The increase in prolactin levels and breast milk volume in the intervention group was statistically higher ($p = 0.000$) than in the group that did not receive the intervention. These findings suggest the potential of katuk leaf cookies as a natural functional food alternative to support increased breast milk production and exclusive breastfeeding programs in healthcare facilities.

Conflict of interest

The authors declare no conflict of interest related to the publication of this article.

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