Mandala of Health
Vol.18, No.1, Juli 2025, Hal. 149-171
ISSN: 0216-3098
DOI: 10.20884/1.mandala.2025.18.1.16222

TORBANGUN (*Coleus amboinicus)* LEAF AS POTENTIAL NEWCOMER IN GALACTOGOGUE OR BREASTMILK BOOSTER: A NARRATIVE REVIEW

Indra Yudhawan[1*], Vino Daniel [2], Putri Khaerani Cahyaningrum[1], Synta Haqqul Fadlilah[3], Dalri Muhammad Suhartomo[4], Ari Wahyudi[1], Akwila Albert Dakusha Putra[5], Intan Diah Pratiwi[5], Nur Hawwin[6], Dhadhang Wahyu Kurniawan[1]

[1]*Department of Pharmacy, Faculty of Health Sciences, Universitas Jenderal Soedirman, Purwokerto*

[2]*Departement of Orthopaedics and Traumatology, Cilegon General Hospital, Cilegon*

[3]*Department of Biochemistry, Faculty of Medicine, Universitas Jenderal Soedirman, Purwokerto*

[4]*Department of Obstetric & Ginecology, Faculty of Medicine, Universitas Jenderal Soedirman, Purwokerto*

[5]*Apotek Unsoed, Universitas Jenderal Soedirman, Purwokerto*

[6]*Gudang Tepung, Warungboto, Yogyakarta*

ABSTRACT

The postpartum period is a critical phase for infant development, and one of the challenges during this time is inadequate or absent lactation, which leads to insufficient breast milk (ASI) production. Baby's growth and development require an adequate amount of nutrition, especially during 6 months of life. Breast Milk is the most fundamental food for babies, and offers complete nutrition for growth and development. However, some mothers are unable to produce enough breast milk for the baby and need to take supplements to stimulate their milk production. Torbangun or Bangun-bangun (*Coleus amboinicus*) leaf is empirically used to increase milk production in some areas of Indonesia. Although, the use of torbangun is not widely used and known. This research offers an investigation and review of many references to find out the current research on torbangun, especially in association with breast milk production. The result shows that there are quite a lot of research has been done related to torbangun in increasing breast milk. Torbangun has proven to have significant potential as a supplement for increasing breast milk production. The research is still in a preliminary study and there is still a few research that could elucidate the mechanism of action of torbangun as galactogogue, the accuracy of dosage, phytochemical compound, and its safety. Therefore, further research is strongly suggested to elucidate this aspect, especially in dosage, standardization, mechanism of action, scientific formulation, phytochemical compound along with its activity and its safety.

Keyword: Breastmilk, *Coleus amboinicus,* Galactogogue, Torbangun

Corresponding author:

Indra Yudhawan
Department of Pharmacy, Faculty of Health Sciences, Universitas Jenderal Soedirman
Jl. Dr. Soeparno, Karangwangkal, Grendeng, Purwokerto 53122
Email: indra.yudhawan@unsoed.ac.id

INTRODUCTION

The postpartum period is a critical phase for infant development, and one of the challenges during this time is inadequate or absent lactation, which leads to insufficient breast milk (ASI) production for some mothers. As a result, some choose to stop breastfeeding and switch to formula feeding, causing infants to miss out on exclusive breastfeeding. This lack of exclusive breastfeeding has been linked to health risks for both the baby and the mother. Breast milk contains vital immune system components that help transfer immunity to the baby, offering protection against infections (Stuebe, 2009).

The first 1000 days of life, also known as *Hari Pertama Kehidupan* (HPK), is considered a golden window for growth and development—an opportunity that does not occur at any other stage of life. Providing adequate nutrition during this period is essential (Rahayu et al., 2018). Breast milk is one of the best sources of nutrition during this time, meeting all of a baby's needs without requiring additional water or food for the first six months. It also plays a key role in supporting the development of the immune system. Exclusive breastfeeding for 6 months has many benefits for the infant and mother. Breastmilk is universally recognized as the optimal form of infant nutrition, providing essential nutrients and immunological protection. The breastfeeding process promotes bonding between mother and child (WHO, 2023).

Lactogenesis, the process of breast milk production, occurs in three stages. The first stage begins around 16–20 weeks of pregnancy. The second stage starts after childbirth and lasts up to 72 hours postpartum, during which early breastfeeding (Early Initiation of Breastfeeding) is strongly encouraged as milk production begins to increase. The third stage takes place between 72–96 hours after birth and focuses on maintaining milk supply (galactopoiesis). Regular breastfeeding or milk expression is necessary to ensure proper emptying of the milk ducts; otherwise, milk flow can become restricted (Lawrence, 2019; Rejeki, 2019)

Exclusive breastfeeding is recommended for the first six months of life to support optimal infant growth and development and ideally can be continued up to two years. When breast milk supply is insufficient, the baby's development may be compromised. However, many mothers experience challenges with insufficient milk supply, a common concern that can lead to early cessation of breastfeeding and reliance on formula feeding (Rahayu et al., 2018). Low milk production was caused by a variety of factors, including infrequent breastfeeding, improper latching or positioning, maternal stress, malnutrition, and hormonal imbalances. The most common factors leading to insufficient milk supply is the disruption in the hormones prolactin and oxytocin, which play a central role in milk production and release (Lawrence, 2019; Rejeki, 2019; Roesli and Yohmi, 2013)

To address low milk supply, many turn to lactation aids such as herbal remedies and commercial breast milk boosters. These products, known as galactagogues, are designed to stimulate or enhance milk production. The study for safe and effective galactagogues, substances that promote or increase breast milk production, is ongoing. While synthetic galactagogues exist, concerns regarding potential side effects and accessibility have driven interest in traditional and herbal remedies. In various cultures, specific plants have been traditionally used by lactating mothers to enhance milk supply. One such plant gaining increasing scientific attention is *Coleus amboinicus*, locally known in Indonesia as Torbangun or Bangun-bangun. Traditionally, the leaves of Torbangun have been consumed by postpartum mothers, particularly in North Sumatra, Indonesia, with anecdotal evidence suggesting its effectiveness in boosting breast milk production and aiding maternal recovery after childbirth. The leaves are often prepared as a vegetable soup or consumed in other culinary forms (Damanik, 2009).

Current scientific investigated the phytochemical constituents of Torbangun leaves, revealing the presence of various bioactive compounds, including alkaloids, sterols, triterpenoids, tannins, and flavonoids. These compounds have been associated with galactagogue properties such as enhanced breast milk production, increased milk protein content, improved ovulation rates, and better protein digestion, all of which contribute to lactation support. In particular, flavonoids are known to stimulate the secretion of prolactin (PRL) and growth hormone (GH), promote the expression of prolactin and growth hormone receptor genes (PRLR and GHR), and support the development of breast tissue (Iwansyah, 2019; Tafzi et al., 2024).

Several in vitro and in vivo studies have been conducted to evaluate the efficacy and safety of Torbangun leaf extracts or preparations as a breast milk booster. These studies have explored its impact on prolactin levels, mammary gland development, and actual milk production in animal models and human subjects. While preliminary findings suggest promising galactagogue activity, further rigorous scientific investigation is crucial to elucidate the underlying mechanisms of action, determine optimal dosage and formulation, and establish its safety profile for lactating mothers and their infants.

This article review aims to comprehensively searching for research and narrating the existing scientific literature on the use of Torbangun (*Coleus amboinicus*) leaf as a galactagogue or breast milk booster along with its phytochemical aspect, and its development potential. By consolidating the current evidence, this review seeks to provide a clearer understanding of the potential benefits and limitations of Torbangun as a natural galactagogue and identify areas for future research.

RESEARCH METHOD

This article is based on a simple narrative literature review. The literature sources come from the Google search engine database, with most of them through Google Scholar searches. Some others are textbooks or standard books that are still related to galactogogue. At least 60% of the literature used comes from the last 5 years, while the other 40% is from any year. There are no restrictions on the literature sources used in this research, but most of them come from Indonesia.

RESULT AND DISCUSSION

Pharmacognosy: Macroscopy

Torbangun (*Coleus amboinicus*) is distributed in many countries. Its origin is still not yet unknown, although some research speculated it is originally from the East Indies, Northern India, or Southeastern Asia. The plant is widely cultivated in Indonesia and Malaysia, commonly in the Malaysian peninsula and throughout southeast Asia. Some cited that Indonesia is the center of diversity. In Java (island), this plant is best grown at 915 m altitude (Morton, 1992).

Coleus amboinicus and *Plectranthus amboinicus* refer to the same plant. Some of the research uses *Coleus amboinicus*, and some of them use *Plectranthus amboinicus* as the Latin name of torbangun. *Plectranthus amboinicus*, on the other hand, is often accidentally misused with *Plectranthus hadiensis* because of its similar appearance. Even though have similar appearances, their pharmaceutical or therapeutic effects are different. Incorrect or unintentional use of these plants might cause therapy become ineffective or maybe cause some adverse effects. *Coleus amboinicus* is recognizable by its green, thick, heart-shaped, and velvety leaves with toothed edges. Its distinct oregano-like taste and smell make it ideal for cooking. The leaves are frequently consumed raw or brewed as tea or juice because they are rich in essential nutrients like calcium, potassium, and iron (Ashaari et al., 2021). Morphological characters observed from *Plectranthus amboinicus* are described in Table I.

Traditionally, Bataknese women consume torbangun leaves, believing it aids in postpartum recovery and increases breast milk (Damanik et al., 2001). Torbangun was popular in bataknese people. Among the Bataknese people of Indonesia, the plant *Coleus amboinicus* Lour, known locally as torbangun, carries a dual nomenclature rooted in its history according to local grandmothers. While the Toba Bataknese refer to it as bangun-bangun, the Simalungun and Karo Bataknese populations know it as either torbangun or tarbangun (Damanik, 2009). Damanik (2009) conducted research about torbangun in Simalungun. In summary, this study highlights the long-standing tradition among Simalungun Bataknese lactating mothers of consuming torbangun during their confinement, a practice that remains robust today. Torbangun is commonly prepared as a soup using a specific method. 120-150 g Young torbangun leaves and tender stems are first cleaned, macerated, and squeezed to reduce bitterness. These leaves are then added to a pot containing coconut milk, water, and sliced chicken (or catfish for an alternative), which are cooked until the meat is done. Separately sautéed spices like salt, garlic, onion, and curcuma are incorporated into the soup, followed by the torbangun leaves, and the mixture is briefly boiled. A touch of lemon juice is added before serving this traditional dish.

Table 1. morphological characteristic of *Coleus amboinicus* (Ashaari et al., 2021; Kaliappan and Viswanathan, 2008; Muthukumarana and Dharmadasa, 2014)

FEATURES	DESCRIPTION
Nature of plants	Herb
Stem	Circular shape, and light-green of color
Petiole	Light-green color with a length of 1.5 ± 0.2 cm
Leaf	Simple, broad, ovate, very thick. The leaf is dorsiventral (distinct upper and lower surfaces) with a smooth surface covered in glandular and non-glandular trichomes (hairs).

Leaf (Detailed Characteristic)	Pointed apex, crenate margin, leathery texture, ventral surface have pale-green color, dorsal surface has light-green color, thick leaf studded with hairs, glandular hair mostly located in dorsal surface
Taste	Pleasantly aromatic and refreshing odor
Flower	Shortly pedicelled, pale purplish,

Pharmacognosy: Microscopy

Kaliappan and Viswanathan (2008) conducted a Pharmacognostical research on the leaves of *Coleus amboinicus*. The leaf was cut, fixated in FAA (Formalin, Acetic Acid, Ethanol), dehydrated, and cased into paraffin blocks to make the histological specimen. The specimen was then cut into many sections with a rotary microtome, dewaxed, and stained with toluidine blue. They use microscope to obtain photomicrographs and then followed by Scanning Electron Micrograph (SEM) analysis to elucidate the more visible and three-dimensional image. Detailed anatomical study examines the cellular organization and tissue arrangement within the leaf and petiole of *Coleus amboinicus*. It emphasizes key characteristics such as the types of hairs (trichomes), the stomata (pores), the vascular bundles (transport tissues), and the various cell types present, ultimately providing a comprehensive structural analysis of this plant. Complete data of microscopic characteristics of the leaf will be described in Table 2.

Table 2. Microscopical morphology characteristics of *Coleus amboinicus* (Kaliappan *et al.*, 2008)

FEATURES	DESCRIPTION
Leaf	The leaf is dorsiventral (distinct upper and lower surfaces) with a smooth surface covered in glandular and non-glandular trichomes (hairs)
Midrib	• The midrib (the central vein) is plano-convex (flat on the upper side and rounded on the lower side) in cross-section. • Its epidermis consists of rectangular to polygonal cells with thin walls. • Stomata (pores for gas exchange) are dacitic (a specific type with subsidiary cells). • The vascular bundles (tissues for transport) are small, top-shaped, and contain xylem (water-conducting tissue) and phloem (food-conducting tissue).
Lamina (Leaf Blade)	• Both upper and lower epidermal layers of the lamina have dense trichomes. • The mesophyll (inner tissue) consists of 9-12 layers of undifferentiated, compact, squarish cells and contains both glandular and non-glandular trichomes, with glandular trichomes being more abundant.
Petiole (Leaf Stalk)	The petiole is roughly rectangular in cross-section with a shallow concavity on the upper (adaxial) side
Tissue Layer	• The epidermis is made of small, rectangular cells. • Beneath it is a narrow zone of 3-4 layers of collenchyma cells (for support), • The remaining ground tissue is composed of large, circular, thin-walled parenchyma cells.
Vascular System	• The vascular system is collateral (phloem surrounding xylem) with radial rows of thin-walled, squarish, wide xylem and thick arcs of phloem.

An understanding of the structure will be achieved when light microscopy is combined with SEM because they complement each other. SEM could reveal microstructures that are not visible with light microscopy, allowing much higher magnification and providing detailed surface information. For example, granules on the leaf will be much more visible with SEM. These granules were not visible when the leaf was examined under a light microscope. However, when the same leaf was viewed under the SEM, these granules became apparent/visible.

Numerous granules were found on the upper epidermis of the leaf. The presence of these granules is potentially significant because similar granules in other plants have been associated with specific compounds like scutellarin and hesperidin crystals. It will be useful to conduct further research to investigate the composition of these granules to increase the insights into the taxonomy of the plant and its phytoconstituents (biologically active compounds). On the other hand, the leaf's thickness and succulence made it impossible to determine the number of vein islets (small areas of leaf tissue surrounded by veins) and vein terminals (ends of veins). Measurements like stomatal density, trichome (hair) length, ash content (total and water-soluble), extractive values (amount of substances extracted by different solvents), and moisture content (loss on drying) could be important.

Pharmacognosy: Source and Method of Preparation Factor

Slusarczyk et al., (2021) conducted research to evaluate the different growing places of torbangun to its chemical composition and effect. They compare protein constituents, phytochemical profile, and antioxidant activities between torbangun from Indonesia and Poland. It was found that the crude protein was higher in torbangun cultivated in Indonesia (21%) than in Poland (13%). Polyphenol levels were found to be higher in torbangun from Poland and have about 1,5 to 2-fold higher antioxidant potential than in Indonesia, measured by DPPH scavenging activity. Torbangun from Indonesia tends to have a higher amount of diterpenoid compound, and overall terpenoid compound was 10 times higher than from Poland (15.59-23.56 µg/g vs 1,87 µg/g of extract). Yuliana et al. (2018) also conducted metabolomic research supporting the argument that environmental factors may cause variation in secondary metabolites, especially in torbangun. Torbangun phytochemical content was quite varied with different geographical origins or growing places. Japanese torbangun has higher total flavonoid content than Indonesian torbangun. Specifically, using the validated HPLC-MWD method, Japanese samples have a higher amount of lutein, but a lower amount of apigenin, than Indonesian samples. In contrast, Eriodyctiol was not found in Japanese torbangun. However, the DPPH radical scavenging assay and alfa-glucosidase inhibitory activity showed that Indonesian torbangun has greater activity compared to Japanese torbanfun, indicating maybe there is another nonflavonoid compound that could also have activity as an antioxidant. The research showed that different locations of growing places could affect the variability of torbangun chemical composition and also its level.

Ashaari et al. (2021) demonstrates that the plant's chemical composition varies depending on the harvesting time. They used Oil Red O staining to visualize lipid droplets,

which indicate the presence of essential oils, in leaf samples. They observed a higher accumulation of these droplets (red color) in leaves collected at 8 p.m. indicating that it is recommended to collect the leaf in the evening to maximize the essential oil product, although the variation is not significant. But for the concern, the levels of the monoterpenes carvacrol and thymoquinone were notably higher in leaves harvested at 2 p.m. This variation, likely influenced by environmental factors like light and temperature, necessitates careful consideration of harvesting time to maintain consistent extract quality. The study recommends harvesting at midday when harvesting total phenolic content (TPC), and total flavonoid content (TFC) as this time yielded the highest levels of the compound.

Muthukumarana and Dharmadasa (2014) conducted research to compare *Plectranthus amboinicus* and Plectranthus hediensis. Agronomic studies show that both plants have increased all growth parameters (plant height, plant spreading, and shoot per plant) with the time forming sigmoid shape growth curve, although a higher number of shoots per plant was observed higher in *Plectranthus amboinicus*. The ratio of fresh materials required to obtain 1 Kg of simplicial was decreased along with maturity. When the plants are harvested at immature stages (before 12 weeks of age), it will require higher number of materials than when harvested at mature stages. It is recommended to harvest torbangun when major yield components are maximum at mature stages after 12 weeks. However, some research has to be done to clearly understand the amount of specific target compounds at different ages when our target is focused on only chemical compounds and not yield.

Drying process could affect the flavonoid content of Torbangun/Jintan Leaves. Widayanti et al., (2023) evaluate the flavonoid level of different drying methods: direct sunlight, exposure to wind (natural airflow), and by oven. Simplicial which has dried by exposing to wind has the highest amount of flavonoid content (5,83 mg QE/g extract), followed by a similar result in the oven (3,58 mg QE/g extract) and direct sunlight (3,38 mg QE/g extract). The result showed that the best drying method to obtain its flavonoid content is by exposing raw material to wind/natural airflow.

Hullatti and Bhattacharjee (2011) also conducted a pharmacognosy evaluation of different parts of torbangun (leaves, stem, and root). The portion of water-soluble extractive value was found to be highest in leaf (30%), followed by stem (15%) and root (11%). The portion of alcohol and ether soluble extractive value was also found to be highest in leaf (13% and 3,5%), followed by stem (7% and 1%) and root (4,4% and 0,8%). This data could become our basis for choosing which part of the torbangun plant will be used to maximize the yields. Other pharmacognosy–physicochemical parameters of torbangun are shown in Table 3.

Table 3. Pharmacognosy-Physicochemical parameters hierarchy of different part of torbangun (Hullatti and Bhattacharjee, 2011)

Parameters	Leaf	Stem	Root
Water soluble extractive values	1st (highest)	2nd	3rd
Alcohol soluble extractive values	1st (highest)	2nd	3rd

Ehter soluble extractive values	1st (highest)	2nd	3rd
Total ash	1st (highest)	2nd	3rd
Water soluble ash value	2nd	3rd	1st (highest)
Acid soluble ash value	1st (highest)	3rd	2nd
Loss of Drying	1st (highest)	2nd	3rd

Phytochemical Content

Torbangun contains many compounds. One of them is phytosterols such as steroid compounds as active substances that have an effect in increasing milk production and important stimulators of mammary gland development, along with its phenolic compound and their probable role in fighting oxidative stress (Risch et al., 2012). Torbangun also has compound 16-hydroxy-7α-acetoxyroyleanone (C22H28O6) that has antioxidant activity which DPPH assay showed that it has IC50 about 384.46 (Gurning et al., 2021). The extracts from torbangun leaves, specifically fractionated using acetone and ethyl acetate contain many biologically active compounds, especially phenolic compounds. These compounds have several biological activities such as antioxidant, antibacterial, and antimutagenic (Gupta et al., 2013). Torbangun dry powder has a blackish-green color, unpleasant odor, and bitter taste (Yulinda and Sholihah, 2022). Phytochemical screening tests of the *Coleus amboinicus* leaf revealed the presence of various compounds in the leaf powder. There are alkaloids, flavonoids, terpenoids, saponins, steroids, tannins, proteins, carbohydrates, and volatile oils (Kaliappan and Viswanathan, 2008; Yulinda and Sholihah, 2022).

HPLC analysis of torbangun methanol extract resulted in several polyphenols (about 15 compounds) consisting of hydroxybenzoic acid, flavonols, and flavon glycoside class. Rosmarinic acid is the main compound, followed by other polyphenols like naringin, catechol, syringic acid, ellagic acid, and myricetin (Taher et al., 2021). Complete list: para hydroxy benzoic acid, chlorogenic acid, vanillic acid, caffeic acid, syringic acid, p-coumaric acid, ferulic acid, salicylic acid, rosmarinic acid, ellagic acid, alfa-coumaric acid, catechol, myricetin, naringenin, rutin (Taher et al., 2021).

Gas Chromatography-Mass Spectrometry (GCMS) analysis of torbangun essential oil, extracted from leaves harvested at various times, revealed 25 compounds categorized into different phytochemical classes. The overall composition remained consistent across all harvesting times, dominated by compounds like carvacrol, γ-terpinene, caryophyllene, p-cymene, trans-α-bergamotene, and thymoquinone. This is significant because carvacrol and thymoquinone have known antioxidants and other bioactivities, suggesting that the time of harvest could influence the potential therapeutic benefits of the essential oil.

Velasco et al. (2009) conducting a studi about torbangun leaves essential oil. 15 components were identified with 99,5% of total abundance in the oil. The main oil compounds in the torbangun leaves were carvacrol (65.2 %), β-caryophyllene (5.0 %), p-cymene (8.5 %) and γ-terpinene (10.0 %). The other complete list of the compounds is α-

Thujene (0.2%), 1-Octen 3 ol (0.3%), Myrcene (0.7%), α-Phellandrene (0.2%), α-Terpinene (1.7%), p-Cymene (8.5%), β-Phellandrene (0.4%), γ-Terpinene (10.0%), α-Terpineol (1.1%), Thymol (0.5%), Carvacrol (65.2%), β-Caryophyllene (5.0%), (E)-α-Bergamotene (2.5%), α-Humulene (1.5%), dan Caryophyllene oxide (1.7%). Singh et al. (2002) also analyzed the leaf oil by GC and GC–MS indicating the presence of six components, accounting for 97% of the total weight of the oil. The major component was thymol (94.3%), followed by Other minor components (1.6%), Unidentified component (1.4%), Carvacrol (1.2%), 1,8-Cineole (0.8%), p-Cymene (0.3%), Spathulenol (0.2%), dan Terpinen-4-ol (0.2%).

El-hawary et al. (2012) conducted research on phytochemical screening of three different parts of *Coleus amboinicus*, which are leaves, stems, and roots. The leaf of *Coleus amboinicus* has several compounds like volatile substances, sterols, free aglycones, flavonoids, glycosides, and catechol tannin. The chemical constituent in the stems and roots is similar to the leaves, but the result of phytochemical screening is not strong enough indicating maybe it has a lower chemical content. The stem extract showed appreciable quantities of antioxidant molecules like rosmarinic acid, caffeic acid, coumaric acid, gallic acid, quercetin, and rutin (Bhatt et al., 2013).

Torbangun leaf also contains some nutrition, like amino acids and vitamins. Three main amino acid constituents are aspartic acid, glutamic acid, and glycine, along with threonine, serine, proline, alanine, valine, isoleucine, leucine, tyrosine, phenylalanine, histidine, lysine, and arginine. The vitamin content in torbangun leaf is mainly Vitamin D. The other are Vitamin A, Vitamin E, Vitamin E, and Vitamin B Complex, with vitamin B2 as the highest amount (El-hawary et al., 2012). This information could be helpful in determining whether torbangun could be utilized as herbal supplementation or could also be utilized as a source of vitamins, especially aspartic acid, glutamic acid, and glycine.

Active Phytochemical Constituent and its Mechanism of Action

Tafzi et al., (2024) conducted a study that showed that torbangun leaf extract contained tannin, flavonoid, steroid, and saponin, but there was no alkaloid or quinone. At the cellular level, water and ethyl acetate fractions increased the expression of genes important to lactation function regulation in mammary epithelial cells. Torbangun leaf extract could increase CSN2 mRNA due to the effect on the pathway, including PRLR, STAT5A, and GR. Iwansyah (2019), on the other hand, found that the ethyl acetate fraction of torbangun leaves could modulate gene expression of estradiol and prolactin hormones. Ethyl acetate extract dosage of 30 mg/kgBW and kaempferol at 60 mg/kgBW cause no significant effect on estradiol and prolactin levels at days 14 and 28 of the lactation period. At the same time, there is a significant downregulation of estradiol receptor genes/ER-alfa (day 28), and also significant upregulation in prolactin receptor gene expression/PRLR, indicating torbangun could affect breast milk production by modulating gene expression on both hormones in the mammary gland of lactating rats. Damanik et al. (2017) specifically found that torbangun contains digiprolactone and kaempferol-3,7-O-di-rhamnopyranoside (kaempferitin). digiprolactone has estrogen

activity, which can selectively activate the estrogen receptor (ER). kaempferol-3,7-O-di-rhamnopyranoside (kaempferitin) has phytoestrogenic action and has effects similar to 17β-estradiol (E2) that promotes the proliferation in MEC (mammary epithelial cell)

Research Related to Torbangun as Galactogogue

There are several studies that have been conducted related to the efficacy of torbangun leaf as a breast milk booster. Most of them are studied in human subjects, meanwhile, the study in animal models especially its mechanism of action is still rare. A preliminary study shows promising galactogogue activity from torbangun leaf to postpartum mother and much of the usage is based on water extract (infusion).

Prahesti and Sholihah (2021) did some quasi-experiment research in Klinik Pratama Amanda, Gamping, Sleman, and Yogyakarta in 14 days to determine the torbangun effect in prolactin level and breastmilk production. The result showed that there is a significant difference in prolactin level and breastmilk production between groups that consume torbangun and groups that didn't consume. Yusibbrahka et al., (2023) conducted some research among 32 breastfeeding mothers in Jakarta to determine the effect of torbangun in breastmilk production. They also made a comparative study of the effect of cassava leaves. The result showed that torbangun leaves have resulted in a slightly higher average increase of breastmilk production, although statistical analysis showed no difference between both groups.

Damanik et al. (2001) explored the practice of consuming torbangun leaves among Bataknese women in North Sumatra, Indonesia, focusing on its role in stimulating breast milk production. They observe women start consuming torbangun soup leaves, shortly 30-40 days after childbirth. The result showed that they reported feeling healthier and more energetic, with a noticeable increase in breast milk. Their study concludes that consuming torbangun leaves is a common practice among Bataknese women to support postpartum recovery and stimulate breast milk production. The complete list of the study is provided in Table 4.

Table 4. The research related to Torbangun as Galactogogue

No	Population	Method	Result	Reference
1	64 breastfeeding mothers with infants aged 0-6 months in the working areas of the Siborong-borong Community Health Center and the Sipoholon Community Health Center in the North Tapanuli Regency.	Analytical observational study with an experimental design using a post-test only control group design. (dosage information not available)	One-way ANOVA revealed that mothers who consumed Torbangun leaf herbal tea had significantly longer and more frequent breastfeeding sessions compared to those who did not ($p < 0.05$).	(Pakpahan and Panggabean, 2023)
2	32 postpartum mothers, 16 control groups and 16 intervention groups	Quasi-experimental with control group design. The dosage of Bangun-bangun leaf extract is	Based on the chi-square analysis, the odds ratio (OR: 2.14; 95% Confidence Interval: 1.08–4.23; p-value: 0.033) indicates that	(Pandiangan and Farlikhatun, 2023)

	receiving bangun-bangun leaf extract.	500 mg. Breast milk output was measured by comparing the volume produced before the intervention and on the fourth day after the intervention. A cutoff point of 500 ml was used to categorize the level of milk production.	consumption of Bangun-bangun leaf extract can increase breast milk production by up to two times compared to not consuming the extract, and this result is statistically significant.	
3	10 breastfeeding mothers	A pre-experimental study using a pre-test and post-test design. Aluminum chloride ($AlCl_3$) method and for total flavonoid, and DPPH (1,1-diphenyl-2-picrylhydrazyl) method for antioxidant (radical scavenging) assay. The food bar was formulated with the addition of 2.5% *Torbangun* flour and 5% *Katuk* flour.	The effectiveness results showed a 54.98% increase in the average volume of breast milk before and after consuming the food bar. The consumption of the food bar had a significant effect on increasing breast milk production ($p<0.05$).	(Lutfiani and Nasrulloh, 2023)
4	30 breastfeeding mothers at PMB Nalom Tangerang.	A pre-experimental study using a pre-test and post-test design. (dosage information not available)	Quantitative data showed a significant rise in average breast milk production scores from 55.00 to 82.00, with a notable increase in the number of mothers achieving higher assessment scores. The Wilcoxon test further confirmed these findings, with 29 out of 30 mothers experiencing a positive change, and a statistically significant p-value of 0.000. These results indicate that Torbangun Leaf Extract can be an effective natural supplement to support lactation in postpartum women.	(P Sembiring and Herawati, 2023)
5	40 postpartum mothers in Ononamolo Village, Gunungsitoli Selatan District, Gunungsitoli City.	Purposive sampling technique. 20 treated with torbangun, 20 trated with ASSI Booster (control). Inclusion criteria: willingness to be a respondent and having	Torbangun leaf consumption could increase breast milk volum in postpartum mothers. Before treatment, there are 5,2% smooth and 94,7% not smooth in breasfeeding with average milk production was 17,9 ml. After treatment, there are 57,9% smooth	(Prawita and Pasaribu, 2020)

		difficulties in breasfeeding their babies.	and 42,1% not smooth in breastfeewing with average milk production was increased to 25,8 ml	
6	30 non smooth mothers, with 50% was more than 30 years old	A pre-experimental study using pre and post-test without control group. (dosage information not available)	Torbangun leaves extract are effective for smooth production of breast milk. The frequency of smoothness breastmilk production is significantly increased from 0% (0 of 30 respondent) before treatment to 76,7% (23 of 30 respondent) after treatment.	(Rochmayanti and Andyarini, 2023)
7	28 postpartum Breastfeeding mothers who gave birth in September 2020 at the Dince Safrina Primary Clinic in Pekanbaru City	non-random sampling technique that included selective sampling of up to 28 people. one-group pretest-posttest design. (dosage information not available)	The consumption of Waking Leaf Soup effective in boosting breast milk production in breastfeering mothers. The average milk production was increased from 70 ml to 189,6 ml after treatment. Also, the frequency of breastfeeding maybe has an effect in increased breasmilk production.	(Irianti, 2021)
8	10 breastfeeding mothers who experienced irregular breast milk flow. Inclusion: postpartum mothers on day 3-40. Exclusion: postpartum more than 40 days	quasi-experiment with one group pre-test and post test without control design. Purposive Sampling method. (dosage information not available)	The results (with Paired Sample T-test, P value of 0.001) showed that torbangun tea could significantly increase breastmilk production. The mean value before treatment was 17.50 and after treatment was 57.00. 4 hours after giving torbangun leaves will increase the volume of breast milk by 47.4%. Mothers who consume bangun bangun leaves say that they feel fresh and not tired.	(Aisyah, 2024)
9	60 respondent (30 for intervention group and 30 for control group). critetia: postpartum mothers, giving birth to live and uncomplicated babies, the condition of the breasts being not blistered,	Quasy Experimental Non-Equivalent Control Group Pretest-Postest Design. non-probability sampling with a consevutive sampling method	there is a significant increase on breast milk production in postpartum mothers after the intervention of Torbangun leaves consumption. In the intervention group, a significant majority of respondents (73.3%, or 22 individuals) breastfed, whereas in the control group, over half (53.3%, or 16 individuals) did not breastfeed.	(Nasution et al., 2022)
10	61 postpartum mother in RSUD Dr.H.Moeloek,	Quasi experiment post-test control group design. Purposive	There was effect of torbangun leaves on the time of breast milk production (on the 3rd day of	(Sherliana et al., 2024)

	Lampung. 30 sample, grouped into 2: 15 mother control group, 15 mother intervention group	sampling, 2 groups. T-test	primiparous postpartum mother). 1	
11	75 healthy pregnant woman in SImalungun Distric, North Sumatera.	Parrallel-randomized intervention study, Purposive sampling, Dosage: 150 g / days / one month	Torbangun soup supplementation could increase the production of breastmilk (without compromise to the nutritional quality of milk).	(Damanik et al., 2006)
12	10 breastfeeding mother experienced irregular breastmilk production in Klinik Bidan Mera, Tanjung Mulia, Medan	Quasi experiment, purposive sampling, one group with pre- and post- test after intervention, without control design.	Torbangun leaf infusion (torbangun leaf "tea") could significantly affect smoothness of breastmilk production between before- and after- treatment of torbangun tea. Torbangun leaf "tea" consumptions could stastitically significant increase the smoothness of breastmilk production in breastfeeding mother	(Sembiring et al., 2024)
13	32 postpartum woman with normal childbirth in Bergas Community Health Center, Semarang	Experimental study with randomizer pre- and post- test control group design, consecutive sampling method.	The consumption of torbangun leaves (for 14 days) could increase breast milk production and prolactin hormone level. There is a significant difference in prolactin hormone level between control group (113,06 ng/ml) and treatment group (152,69 ng/ml).	(Herlina et al., 2018)
14	20 postpartum mother having baby 0-6 years old in Sidomulyo, Birubiru, North Sumatera. Control group (10), treatment group (10).	Quasi Experiment, Non-equivalent control group approach.	Torbangun "TOR" tea could significantly increase breastmilk production, and also 70 percent of them doesn't have problem in lactation.	(Natalia, 2023)
ANIMAL MODEL (EXPERIMENT)				
1	30 breastfeeding wistar rats, divided into 5 groups with 5 rats each group. Experimental Study Design. Treatment groups: 108 mg, 216 mg, and 432 mg torbangun leaf powder (TLP). Positive control: domperidone. Negative control: CMC 10%. 3 times daily for 14 days.		Torbangun leaves treatment could increase prolactin levels in breastfeeding rats (Turkey's HSD mean test). Also, there is no significant difference in the body weight between treatment groups.	(Hasianna et al., 2021)

2	25 lactating dams weighing 250-300 g at the beginning of lactation and suckling six pup, divided into five groups (5 animals each group). Group I (KO) control with vehicle orally, Group II (AF) milk booster (composition: 114 mg katuk leaf extract, 20 μg vitamin B12, 25 mg vitamin B2, 10 mg vitamin B1) at a dose of 50 mg/kg BW. Group III & IV (EA/ethyl acetate) 30 mg/kg of ethyl and 80 mg/kg BW of aqueous extract of torbangun, respectively. Group V (KP) kaempferol compound at a dose of 60 mg/kg BW. Milk production was measured from day 3 to day 15 of lactation.	The Kaempferol group (KP) at a 60 mg/kg body weight dose demonstrated the highest total milk production, outperforming other fractions (AF, EA, KO, and AQ). Notably, the ethyl acetate fraction of torbangun leaves (EA) at a 30 mg/kg dose stimulated milk production by approximately 17% compared to the control group; however, this fraction did not significantly impact serum prolactin synthesis at either Day 14 or Day 28.	(Damanik et al., 2017)
3	24 female Sprague-Dawley rats weighing 200–250. Aclimated at a 12-hour day–night cycle, standard feed, unrestricted access to water, temperature ranging between 20°C and 25°C, and humidity levels between 40% and 70% for 1 Divided into four groups consisting of six dams and five pups per dam. Dam rats and their offspring were housed in cages. The four lactating groups were classified as Group 1 (normal control, with distilled water); Groups 2–4 (blended extracts at 37.5, 75, and 150 mg/kg, respectively) Sample: Blended Extract (*Sauropus androgynus*, *Moringa oleifera*, and *Coleus amboinicus* (1:1:1) with percolation at 60°C for 90 minutes with pharmaceutical grade ethanol 70% solvent.	The blended extract at a dose of 75 mg/kg cause a significant increase in milk volume compared to the control group. This enhancement is further supported by larger alveolar structures seen in the extract group, suggesting an improved tissue architecture for lactation. The alveolar lumen was more spacious in the treatment and was filled with milk in the milk group.	(Intan et al., 2024)

Effect Related to Mother Health and Child Growth

Many research has been done to prove torbangun as galactogogue. Meanwhile, several effects which still related to supported postpartum mother or baby health have also been conducted. It is important to give mother or their baby adequate nutrition and health support from the drug or food, especially from supplements. Torbangun has many beneficial properties to support this with its immunomodulatory, antioxidant, anti-inflammatory, antibacterial activity, and its nutritional content.

Nutrition

Torbangun also has nutritional benefits. Torbangun leaf contains amino acids (mainly aspartic acid, glutamic acid, and glycine), and some vitamins (vitamin D, A, E, and B Complex) (El-hawary et al., 2012). Nababan et al. (2024) have performed preliminary research to examine the nutritional effect of torbangun biscuits. They

developed biscuits from torbangun leaves that could serve as a practical and nutritious source of food products. They conducted an intervention for two groups, one group was given torbangun biscuits, and the other was not given. The result showed that children who consumed torbangun leaf biscuits had a significant increase in body length compared to the other groups (regular/placebo groups, suggesting the high potential of torbangun biscuits to be further studied and mass produced.

Immunomodulator and Antioxidant Activity

Silitonga et al., (2014) have done research to determine the levels of apigenin in torbangun leaves and evaluate its immunostimulatory activity in rats. The data showed that there was 0.0236 ng apigenin/ml sample. Torbagun treatment with a dosage of 500 mg/kgBW induces a significant change in monocyte level, increasing lysozyme activity, and relatively higher levels of IgM and IgG, liver weight, and spleen weight. The increase in immunological parameters could become supporting factors to help the mother being healthy and the baby's growth become optimal. Lutfiani and Nasrulloh (2023) made fluor from torbangun and katuk leaf. They performed a chemical analysis of torbangun, which revealed that the total flavonoid content in Torbangun and Katuk flour was 4.06 mg/g and 5.30 mg/g, respectively, while their antioxidant activity was 39.77 ppm and 307.96 ppm. Meanwhile, the total flavonoid content and antioxidant activity of the Torbangun-Katuk food bar product were 0.36±0.06 mg/g and 116.01±36.83 ppm, respectively.

Antiinflamatory and Antibacterial Activity

Mulyani et al., (2023) found that a combination of torbangun and kelor (*Moringa olifera*) could have a beneficial effect as a strong antiinflamatory agent with the combination of torbangun:kelor and IC50 details are follows: (1:3, 74,23 ppm), (1:4, 50,80 ppm), and (1:5, 74,23 ppm). The anti-inflammatory agent could support the health of the postpartum mother, while postpartum mothers are commonly prescribed non-steroidal anti-inflammatory drugs (NSAID) for pain (Wuytack et al., 2021). Suryowati et al (2024) conducted antibacterial assay from torbangun leaf extract. 15% torbangun leaf extract has inhibitory activity against *Escherichia coli* pBR322 with a mortality rate of 50% of larvae at a concentration of 150 ppm. Torbangun also has antibacterial activity against *F. nucleatum* (Anggraeni et al., 2024), and *Propionibacterium acne* (Hilmarni, 2023; Roslianizar et al., 2021). Torbangun essential oil (6% and 8%) shows great antibacterial activity with inhibition diameters of 20,23 mm and 22,83 mm to *Staphylococcus aureus* (Hilmarni et al., 2021) also 26,78 mm and 30,14 mm to *Propionibacterium acne* (Hilmarni, 2023).

Product and Formulation of Torbangun

Research suggests that the bangun-bangun plant (*Coleus amboinicus* Lour) can effectively increase breast milk production in lactating mothers. Some studies have shown significant effects on breastmilk production in postpartum mothers consuming bangun-bangun leaf soup or as a supplement Nasution et al. (2022) found that 100 g of bangun-bangun leaves consumed three times a day for a week could increase breasmilk production in postpartum. Rustiani and Awinda were made effervescent from a combination of torbangun and asam jawa (Tamarindus indica) related to their antidiabetic and antioxidant potency. They were making 3 formulas and obtained the best formula which have 7% citric acid, 14 tartaric acid, and 25% bicarbonate sodium (Erni Rustiani and Ulfa Nur Awinda,

2022). Sholihah conducting research to determine the best effervescent formulation. Torbangun with natrium bicarbonate content (26.56 grams) gave an excellent solubility effect in water, with this the galactagogue content in Torbangun extract is more free and effective for breast milk production (Sholihah and Sari, 2022). Alfitra et al., (2010) made supplement drink from Torbangun leaves for relieving premenstrual syndromes (PMS). The best formulation based on organoleptic, physical, and chemical aspects is formula DT3 which consists of 10 g torbangun leaves extract, 4 g lemon, and 28 g sucrose.

Mastuti et al. (2024) produced a healthy drink (they call it "milk tea" drink) for breastfeeding mothers with the composition of almond milk and steeping water (consisting of 2 plants: torbangun leaf and fenugreek seed). The healthy drink with the composition of almondmilk and stepping water (torbangun: fenugreek = 1:2) have the best activity. It has an antioxidant IC50 value of 793,99 mg/L, total phenolic content of 1441.56 mg/L; and total flavonoid content of 950 mg/L. It also has relatively high mineral content, such as calcium 7.38 mg/100 mL, magnesium 7.28 mg/100 mL, potassium 36.02 mg/100 mL, and iron 0.72 mg/100 mL.

Several simple formulations (for example food food-based products) have been made by several researchers. For example, there is torbangun "tea powder", packed in empty tea bags (Girsang, 2021), Torbangun based – brownies. It could significantly increase breastmilk production, although the dosage and formulation are not available in the journal (Sariaty et al., 2021). Also, Ttorbangun flour-based functional supplementary food. Formula F3 (12 gram torbangun flour) combined with corn flour, isolated soy protein, skimmed milk product, and sugar powder. F3 contained 376 kcal energy / 100 g flour, water absorption index at 3.06, and water solubility 76,96% (Doloksaribu et al., 2015).

Many studies found a significant effect on breast milk production in mothers given bangun-bangun as described before in this paper. These findings suggest that bangun-bangun leaves can be an effective natural remedy for mothers experiencing insufficient milk production, potentially supporting exclusive breastfeeding practices. The main problem is the use of torbangun still needs work to improve its function. However, there aren't many formulations that have been made to maximize the effect of torbangun as galactogogue as well as lack of information on its safety.

Community Health Services of Torbangun

Torbangun starting to be widely believed to have beneficial activity in breastmilk production. Various research has been conducted (Table VI.) and it will be better for the community to find out this benefit. There are still a few numbers of community services carried out by academia and physicians to escalate the information and reach a wider community. We have summarized the community services related to torbangun as a galactogogue in Table 6.

Table 6. Community health service associated with torbangun as breastmilk booster

No	Speaker / Educator	Activity
1	(Husna et al., 2021)	Husna, in collaboration with Grandmed Lubuk Palam Hospital giving community health service to the 15 postpartum patients in the hospital. The activity has been done in 3 days. The participants gave well respond to the

		community service. Breastfeeding normally lasted for about 2-3 minutes. After being given torbangun leaves, on average, breastfeeding lasted for about 11.6 minutes with the longest duration of up to 17 minutes per breastfeeding.
2	(Andrestian et al., 2023)	Andrestian giving community health service about torbangun. The target group was 15 members of the PKK PKK Lok Gabang Village who will become agents of change in the work area of the Astambul Health Center, Banjar Regency, South Kalimantan Province. The methods implemented in this activity are education and practice related to breastfeeding, Torbangun plant cultivation, and Torbangun leaf product innovation practices and commercialization efforts.
3	(Andrestian et al., 2024)	Andrestian provides information about the importance of breastfeeding for babies to Posyandu cader and pregnant women in Antasan Senior Village, Martapura Timur, Banjar. They introduce torbangun leaves as a breast milk stimulant, torbangun cultivation, making innovative products from torbangun leaves or torbangun leaf flour. Pre and post-tests were conducted to see changes in behavior/knowledge of 7 integrated health post cadres and 3 pregnant women and resulted in increased awareness of participants to improve breastfeeding practices, cultivation of torbangun, and processed product development.
4	(Girsang, 2021)	Girsang and team provide community health services to the 50 women in Posyandu Cempaka IB, Lingkungan I, Bangun City, Medan, North Sumatera. They made breast milk booster with 500 gr torbangun leaves, cleaned, then cut into small pieces of 2-3 cm, and sdried at a temperature of 50C for 3 hours. The size is reduced again to form tea powder, packed in empty tea bags and packaged secondarily in pouches. The participant's knowledge about MB TESI (*Membuat Booster ASI* /Making Breastmilk Booster) was increased.
5	(Purba et al., 2023)	Purba provides community service to increase the knowledge about stunting, treatment,s and nutrition needed by babies during growth and development. They produce TOR Biscuits (torbangun biscuits). TOR Biscuits are biscuits combined with torbangun leaf powder. TOR Biscuits were given to 77 stunted babies aged 12-18 months in Belawan 1, Belawan 2, Bahari, Sicanang, and Bagan Del Sub-districts as complementary food.
6	(Fitriani et al., 2024)	Fitriani giving community service to 40 participants (pregnant and breastfeeding mothers) at Puskesmas Perumnas II. They give lectures and discussions on exclusive breastfeeding and gave torbangun tea and black cumin capsules as breast milk boosters. They give pre- and post-test to the participant which resulted in increased understanding from participants about importante of exclusive breastfeeding and how to increase breastmilk production.

CONCLUSION

The existing scientific research and empirical study strongly suggest that *Coleus amboinicus* (Torbangun) leaves hold significant promise as a natural galactagogue to address insufficient breast milk production, a common challenge in the critical postpartum period. This plant, widely recognized in Indonesian traditional medicine, contains various bioactive compounds, notably flavonoids, which are believed to stimulate prolactin and growth hormone secretion, enhance receptor gene expression, and support mammary tissue

development, thereby promoting lactation. While preliminary in vivo and in vitro studies indicate positive effects on milk volume and prolactin levels in both animal models and human subjects, the current body of research often lacks the rigor to definitively establish optimal dosages, precise mechanisms of action, and a comprehensive safety profile for widespread clinical application. Therefore, continued rigorous scientific investigation, including well-designed human trials and molecular-level studies, is essential to fully validate Torbangun's efficacy and safety, paving the way for its potential as galactogogue, along with introducing to the community with more massive community health services to maximize its benefit.

CONFLIC OF INTEREST

Author declared there is no conflict of interest

ACKNOWLEDGEMENT

I would like to express my gratitude to dr. Vino Daniel Sp.OT for his valuable inspiration and helpful recommendation during the planning stage of the research.

REFERENCES

Aisyah, S., 2024. Efektivitas Pemberian Teh Daun Bangun (Coleus Ambonicolory) Terhadap Kelancaran Produksi Asi Ibu Menyusui.

Alfitra, P., Setiawan, B., Damanik, M.R., 2010. Formulasi Minuman Suplemen Daun Torbangun (coleus Amboinicus Lour.) Untuk Wanita Yang Menderita Pms (premenstrual Syndrome). J Gizi Pangan 5, 95. https://doi.org/10.25182/jgp.2010.5.2.95-102

Andrestian, M.D., Dewi, Z., Mas'odah, S., Hapisah, H., 2024. Introduction of Torbangun Leaves as the Best Traditional Lacteous and its Processing Innovations in Antasan Senor Village, Banjar Regency, South Kalimantan, Indonesia. Jurnal Pengabdian kepada Masyarakat 08.

Andrestian, M.D., Mas'Odah, S., Dewi, Z., Hapisah, H., 2023. Pengenalan, Budidaya, dan Inovasi Produk Laktagogum Daun Torbangun di Kabupaten Banjar, Kalimantan Selatan. MCM 1, 104–115. https://doi.org/10.63004/mcm.v1i3.178

Anggraeni, R., Pakpahan, A., Manalu, J., 2024. Effect of Hexane Fractionation of Plectranthus amboinicus Leaf Extract on the Formation of Fusobacterium nucleatum Inhibition Zone.

Ashaari, N.S., Mohamad, N.E., Afzinizam, A.H., Ab. Rahim, M.-H., Lai, K.S., Ong Abdullah, J., 2021. Chemical Composition of Hexane-Extracted Plectranthus amboinicus Leaf Essential Oil: Maximizing Contents on Harvested Plant Materials. Applied Sciences 11, 10838. https://doi.org/10.3390/app112210838

Bhatt, P., Joseph, G.S., Negi, P.S., Varadaraj, M.C., 2013. Chemical Composition and Nutraceutical Potential of Indian Borage (*Plectranthus amboinicus*) Stem Extract. Journal of Chemistry 2013, 320329. https://doi.org/10.1155/2013/320329

Damanik, R., 2009. Torbangun (Coleus amboinicus Lour): A Bataknese Traditional Cuisine Perceived as Lactagogue by Bataknese Lactating Women in Simalungun, North Sumatera, Indonesia. J Hum Lact 25, 64–72. https://doi.org/10.1177/0890334408326086

Damanik, R., Damanik, N., Daulay, Z., Saragih, S., Premier, R., Wattanapenpaiboon, N., Wahlqvist, M., 2001. Consumption of bangun-bangun leaves (Coleus amboinicus Lour) to increase breast milk production among Batakneese women in North Sumatra Island, Indonesia.

Damanik, R., Wahlqvist, M.L., Wattanapenpaiboon, N., 2006. Lactagogue effects of Torbangun, a Bataknese traditional cuisine. Asia Pac J Clin Nutr 15, 267–274.

Damanik, R.M., Kustiyah, L., Hanafi, M., Iwansyah, A.C., 2017. Evaluation Lactogenic Activity of Ethyl Acetate Fraction of Torbangun (*Coleus amboinicus* L.) Leaves. IOP Conf. Ser.: Earth Environ. Sci. 101, 012007. https://doi.org/10.1088/1755-1315/101/1/012007

Doloksaribu, T.H., Syarief, H., Damanik, R., Anna, S., 2015. The Development of Torbangun Flour-Based Functional Supplementary Food for Breastfeeding Mother. International Journal of Sciences 23.

El-hawary, S.S., El-sofany, R.H., Abdel-Monem, A.R., Ashour, R.S., 2012. Phytochemical Screening, DNA Fingerprinting, and Nutritional Value of Plectranthus amboinicus (Lour.) Spreng. Pharmacognosy Journal 4, 10–13. https://doi.org/10.5530/pj.2012.30.2

Erni Rustiani, Ulfa Nur Awinda, 2022. Effervescent Granule Formulation Combination of Coleus amboinicus Leaves Extract and Tamarindus indica Pulp Extract. J Jamu Indo 7, 25–30. https://doi.org/10.29244/jji.v7i1.214

Fitriani, H., Sulistiawati, R., Fitriyani, M., 2024. Pengaruh Pemberian Daun Bangun – Bangun (coleus Ambonicus Lour) Terhadap Produksi Asi. JKK 2.

Girsang, B.M., 2021. Pendampingan "Mb TESI" (Membuat Booster ASI) Daun Teh Torbangun. jpb 3, 1–5. https://doi.org/10.33884/jpb.v3i01.2692

Gupta, S.K., Bhatt, P., Joseph, G.S., Negi, P.S., Varadaraj, M.C., 2013. Phenolic constituents and biological activities of leaf extracts of traditional medicinal plant Plectranthus amboinicus Benth (Lamiaceae). Tang [humanitas Medicine] 3, 32.1-32.6. https://doi.org/10.5667/TANG.2013.0027

Gurning, K., Haryadi, W., Sastrohamidjojo, H., 2021. Isolation and Characterization of Antioxidant Compounds of Bangun-Bangun (coleus Amboinicus, L.) Leaves from North Sumatera, Indonesia. RJC 14, 248–253. https://doi.org/10.31788/RJC.2021.1416077

Hasianna, S.T., Ivone, J., Shinta, S.D., Nadhira, R.Z., 2021. The Use of Torbangun Leaf Powder (Coleus amboinicus L) in Increasing Prolactin in Breastfeeding Wistar Rats and Body Weight of The Litters. Journal of Medicine and Health 3.

Herlina, Hadisaputro, S., Aristiati, S.K., 2018. Torbangun (Coleus Amboinicus L) leaves extract as an alternative to increase breast milk production and prolactin hormone level among normal postpartum women (study in the work area of bergas community health center Semarang district) 6.

Hilmarni, H., 2023. Aktivitas Antibakteri Minyak Atsiri Daun Torbangun (plectranthus Amboinicus) Terhadap Bakteri Propionibacterium Acnes. SITAWA 2. https://doi.org/10.62018/sitawa.v2i1.39

Hilmarni, H., Rosi, D.H., Kusuma, A.E., 2021. Isolasi dan Pengujian Aktivitas Antibakteri Minyak Essensial Daun Torbangun (Plectranthus Amboinicus (Lour.) Spreng

terhadap Bakteri Staphylococcus aureus. Higea 13, 65. https://doi.org/10.52689/higea.v13i2.361

Hullatti, K., Bhattacharjee, P., 2011. Pharmacognostical Evaluation of Different Parts of Coleus amboinicus lour., Lamiaceae. Pharmacognosy Journal 3, 39–44. https://doi.org/10.5530/pj.2011.24.8

Husna, N., Panjaitan, R., Panjaitan, D.B., 2021. Sosialisasi Pemberian Daun Torbangun Untuk Meningkatkan Produksi Asi Terhadap Ibu Nifas Di Rumah Sakit Grandmed Lubuk Pakam. JPK 1, 45–48. https://doi.org/10.35451/jpk.v1i1.716

Inggas, Made Agus M., et al. Biokimia, Biologi Molekuler dan Aplikasinya Dalam Bidang Kesehatan. Mafy Media Literasi Indonesia Publisher, 2024, doi:10.1112/kakinaan1132.

Intan, P., Alegantina, S., Isnawati, A., Yunarto, N., Ekawasti, F., Rinendyaputri, R., Sunarno, S., Sani, Y., Mariya, S., Handharyani, E., 2024. **Effects of a blend extract of *Sauropus androgynus*, *Moringa oleifera*, and *Coleus amboinicus* on milk production in lactating rats**. Open Vet J 14, 3630. https://doi.org/10.5455/OVJ.2024.v14.i12.44

Irianti, B., 2021. Effectiveness of Torbangun Leaf Soup in Increasing Breast Milk Production in Breastfeeding Women in Dince Safrina Pratama Clinic, Pekanbaru City. Journal Of Midwifery And Nursing 3.

Iwansyah, A.C., 2019. The Ethyl Acetate Fraction of Torbangun (Coleus amboinicus L.) Leaves Increasing Milk Production With Up-Regulated Genes Expression of Prolactin Receptor. J.Trop.Life.Science 9. https://doi.org/10.11594/jtls.09.02.03

Kaliappan, N., Viswanathan, P., 2008. Pharmacognostical studies on the leaves of *Plectranthus amboinicus (Lour) Spreng*. Int J Green Pharm 2, 182. https://doi.org/10.4103/0973-8258.42740

Lawrence, R.M., 2019. 11 - The Breast and the Physiology of Lactation. Elsevier.

Lutfiani, L., Nasrulloh, N., 2023. Total Flavonoid dan Aktivitas Antioksidan Food Bar Torbangun – Katuk terhadap Efektivitas Produksi ASI: Total Flavonoid and Antioxidant Activity of Food Bar Torbangun – Katuk on The Effectiveness of Breast Milk Production. AMNT 7, 88–97. https://doi.org/10.20473/amnt.v7i1.2023.88-97

Mastuti, T.S., Djuarsa, V.A., Matita, I.C., 2024. Karakteristik 'Teh Susu' Kombinasi Seduhan Daun Torbangun Dan Biji Fenugreek Serta Susu Almond Yang Berpotensi Sebagai Minuman Kesehatan Ibu Menyusui. JSTFaST 8, 1. https://doi.org/10.19166/jstfast.v8i1.8159

Morton, J.F., 1992. Country Borage (*Coleus amboinicus* Lour.): A Potent Flavoring and Medicinal Plant. Journal of Herbs, Spices & Medicinal Plants 1, 77–90. https://doi.org/10.1300/J044v01n01_09

Mulyani, T., Setyahadi, S., Wibowo, A.E., 2023. Uji Aktivitas Antiinflamasi Kombinasi Ekstrak Daun Torbangun (Plectranthus amboinicus (Lour.) Spreng.) dan Ekstrak Daun Kelor (Moringa oleifera Lam.) dengan Metode Penghambatan Denaturasi Protein. Pharmaceutical Journal of Indonesia 20.

Muthukumarana, R., Dharmadasa, R.M., 2014. Pharmacognostical investigation of *Plectranthus hadiensis* (Forssk.) Schweinf. ex Sprenger. and *Plectranthus amboinicus* (Lour.) Spreng. WJAR 2, 240–246. https://doi.org/10.12691/wjar-2-5-7

Nababan, D., Ismail, R., Sihotang, D., 2024. Overcoming Stunting Through Local Wisdom Community Towards a Food Consumption Diversity: A Preliminary Research of

Torbangun Leaves (Coleus Amboinicus L) Biscuit. RGSA 18, e05557. https://doi.org/10.24857/rgsa.v18n5-048

Nasution, S.S., Eliana, R., Aizar, E., Pramita, R., 2022. Effectiveness of Coleus Amboinicus Consumption Interventions in Increasing Breast Milk Production and Improving Maternal Health Status During COVID 19 Pandemic. Open Access Maced J Med Sci 10, 202–208. https://doi.org/10.3889/oamjms.2022.7094

Natalia, K.-, 2023. Pengaruh Teh Tor Bangun Terhadap Peningkatan Produksi Asi. Midwifery 5, 8–12. https://doi.org/10.36656/jpk2r.v5i2.1230

P Sembiring, E., Herawati, I., 2023. The Effectiveness Of Providing Torbangun Leaf Extract (Coleus Ambonicus Lour) On Breast Milk Production For Postpartum Mothers At PMB Nalom Tangerang In 2022. IJHP 3, 692–697. https://doi.org/10.51601/ijhp.v3i4.242

Pakpahan, S., Panggabean, H., 2023. Herbal Tea of Torbangun Leaf and Exclusive Breastfeeding: Related Factors and Impact on the Duration of Breastfeeding. jika 8. https://doi.org/10.30604/jika.v8i4.2432

Pandiangan, M., Farlikhatun, L., 2023. Effectiveness of Bangun-Bangun Leaf (coleus Amboinicus Lour) on Breast Milk Production in Post Partum Mothers 4.

Prahesti, R., Sholihah, N.R., 2021. Daun Torbangun (coleus Amboinicus L) Meningkatkan Kadar Prolaktin Dan Produksi Asi Pada Ibu Menyusui. Media ilmu kesehatan 9, 21–25. https://doi.org/10.30989/mik.v9i1.335

Prawita, A.A., Pasaribu, S.E., 2020. The Effect of Torbangun Leaves Consumption on the Improvement of Breastmilk Volume in Post Partum Women in Ononamolo Village, Gunungsitoli City. HN 4, 400–403. https://doi.org/10.33846/hn41202

Purba, I.E., Nababan, D., Martina, S.E., Zebua, J.D., 2023. Pemanfaatan TOR BISKUIT sebagai MP-ASI pada Bayi Stunting Usia 12-18 Bulan. jpni 4, 722–726. https://doi.org/10.35870/jpni.v4i3.454

Rahayu, A., Rahman, F., Marlinae, L., Husaini, Meitria, Yulidasari, F., Rosadi, D., Laily, N., 2018. Buku Ajar Gizi 1000 Hari Pertama Kehidupan. CV Mine, Yogyakarta.

Rejeki, P.S., 2019. Catatan Kami tentang ASI. Oksana Publishing.

Risch, A., Sakinah, A.M.M., Astuti, S.M., 2012. Determination of Active Substances in Torbangun Plant (*Coleus amboinicus Lour*) by Using Gas Chromatography-Mass Spectrophotography (GCMS) and Potential Component Analysis (PCA) for Increasing Women Milk Production.

Rochmayanti, S.N., Andyarini, E.N., 2023. The Effectiveness of Giving Bangun-bangun Leaf (Coleus Amboinicus Lour) Extract to Smooth Breast Milk Production as an Effort to Prevent Stunting in the Sidotopo Public Health Center of Surabaya. ICHAFOHN 1, 119–124. https://doi.org/10.29080/ichafohn.v1i1.1146

Roesli, U., Yohmi, E., 2013. Manajemen Laktasi (Ikatan Dokter Anak Indonesia), sumber: Buku Bedah ASI IDAI [WWW Document]. Ikatan Dokter Anak Indonesia. URL https://www.idai.or.id/artikel/klinik/asi/manajemen-laktasi (accessed 5.20.24).

Roslianizar, S., Sembiring, E., Harianja, E.S., Tamba, B., 2021. Uji Daya Anti Bakteri Dari Ekstrak Etanol Daun Bangun- Bangun (coleus Ambonicius L.) Terhadap Bakteri Penyebab Jerawat (propionibacterium Acnes) 3.

Sariaty, S., Yulinda, Y., Nazma, N.N., 2021. Efektivitas Pemberian Brownis Bangun-Bangun (coleus Ambonicus Lour) Terhadap Produksi Asi. JKS 2, 696–702. https://doi.org/10.34011/jks.v2i2.751

Sembiring, E.R.B., Pratiwi, D., Oktafirnanda, Y., 2024. Efektivitas Pemberian Teh Daun Bangun Bangun (Coleus Ambonicolory) Terhadap Kelancaran Produksi Asi Ibu Menyusui Di Klinik Bidan Mera Tanjung Mulia Kec Medan Deli Tahun 2024 9.

Sherliana, Yantina, Y., Susilawati, 2024. Pengaruh Pemberian Ekstrak Daun Terbangun (coleus Ambonicus Lour) Terhadap Pengeluaran Asi Hari Ke-3 Pada Ibu Primipara Di Rsud Dr.h. Abdul Moeloek Povinsi Lampung 4.

Sholihah, N.R., Sari, K.R.P., 2022. Studi Preformulasi Tablet Effervescent Daun Torbangun (coleus Amboinucus L) Sebagai Alternatif Peningkatan Produksi Asi. j. medikes 9, 17–28. https://doi.org/10.36743/medikes.v9i1.344

Silitonga, M., Ilyas, S., Hutahaean, S., Sipahutar, H., 2014. Levels of Apigenin and Immunostimulatory Activity of Leaf Extracts of Bangunbangun (Plectranthus Amboinicus Lour). IJB 7, p46. https://doi.org/10.5539/ijb.v7n1p46

Singh, G., Singh, O.P., Prasad, Y.R., De Lampasona, M.P., Catalan, C., 2002. Studies on essential oils, Part 33: chemical and insecticidal investigations on leaf oil of *Coleus amboinicus* Lour. Flavour & Fragrance J 17, 440–442. https://doi.org/10.1002/ffj.1123

Slusarczyk, S., Cieślak, A., Yanza, Y.R., Szumacher-Strabel, M., Varadyova, Z., Stafiniak, M., Wojnicz, D., Matkowski, A., 2021. Phytochemical Profile and Antioxidant Activities of Coleus amboinicus Lour. Cultivated in Indonesia and Poland. Molecules 26, 2915. https://doi.org/10.3390/molecules26102915

Stuebe, A., 2009. The Risks of Not Breastfeeding for Mothers and Infants. MedReviews 2.

Suryowati, T., Yang, J.J., Sunarti, L.S., Bintang, M., 2024. The Effect of Torbangun (Coleus amboinicus Lour) Leaf Extract on Antibiotic Resistant Bacteria Escherichia coli pBR322 and Toxicity Tests on Artemia salina Leach. IJAR 5, 1–8. https://doi.org/10.30997/ijar.v5i1.388

Tafzi, F., Andarwulan, N., Giriwono, P.E., Dewi, F.N., 2024. Torbangun (Plectranthus amboinicus (Lour.) Spreng) Leaf Extract Upregulates Expression of Lactation-Related Genes in Human Mammary Epithelial Cells MCF-12A. IFSTJ 8, 52–59. https://doi.org/10.22437/ifstj.v8i1.37364

Taher, M., El-Daly, N., El-Khateeb, A.Y., Hassan, S., Elsherbiny, E.A., 2021. Chemical Composition, Antioxidant, Antitumor and Antifungal Activities of Methanolic Extracts of Coleus blumei, Plectranthus amboinicus and Salvia splendens (Lamiaceae). Journal of Agricultural Chemistry and Biotechnology 12, 177–187. https://doi.org/10.21608/jacb.2021.209208

Velasco, J., Rojas, L.B., Díaz, T., Usubillaga, A., 2009. Chemical Composition and Antibacterial Activity of the Essential Oil of *Coleus amboinicus* Lour., Against Enteric Pathogens. Journal of Essential Oil Bearing Plants 12, 453–461. https://doi.org/10.1080/0972060X.2009.10643744

WHO, 2023. WHO Guideline for Complementary Feeding of Infants and Young Children 6-23 Months of Age, 1st ed. ed. World Health Organization, Geneva.

Widayanti, E., Mar'ah Qonita, J., Ikayanti, R., Sabila, N., 2023. Pengaruh Metode Pengeringan terhadap Kadar Flavonoid Total pada Daun Jinten (Coleus amboinicus Lour). IJPE 3. https://doi.org/10.37311/ijpe.v3i2.19787

Wuytack, F., Smith, V., Cleary, B.J., 2021. Oral non-steroidal anti-inflammatory drugs (single dose) for perineal pain in the early postpartum period. Cochrane Database of Systematic Reviews 2021. https://doi.org/10.1002/14651858.CD011352.pub3

Yuliana, N.D., Sugiharto, M.A., Lioe, H.N., Goto, M., Ishikawa, Y.T., 2018. NMR metabolomics revealed metabolites and bioactivity variation in Torbangun leaves Plectranthus amboinicus L. with different origins. Indones. J. Biotechnol. 23, 91. https://doi.org/10.22146/ijbiotech.38659

Yulinda, D., Sholihah, N.R., 2022. Identifikasi Profil Fitokimia Daun Torbangun (coleus Amboinicus) Untuk Meningkatkan Produksi Asi. KesMaDaSka 153–157. https://doi.org/10.34035/jk.v13i2.838

Yusibbrahka, S., Carolin, B.T., Silawati, V., 2023. Comparison of The Effectiveness of Decil of Bangun-Bangun Leaf with Cassava Leaves in The Production of Breast Milk. HTechJ 1, 205–211. https://doi.org/10.53713/htechj.v1i2.37