

## REVIEW: A STUDY ON THE USE OF GOTU KOLA EXTRACT (*Centella asiatica* (L.) Urb.) AS A TREATMENT FOR ACNE

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### ABSTRACT

Acne is an inflammatory skin condition caused by sebaceous follicles and characterized by skin inflammation in the form of a buildup of bacteria and oil that clogs pores and causes acne. *Centella asiatica* (L.) Urb., often known as gotu kola, has antibacterial properties that inhibit *Propionibacterium acnes*, thereby reducing papules, pustules, and nodules. Antioxidants, asiatic acid, and madecassic acid found in gotu kola (*Centella asiatica* (L.) Urb.) can treat wounds. Skin damaged by acne can be repaired and rejuvenated with gotu kola antioxidants, which also help collagen formation more quickly in the skin. This research aims to examine the ability of gotu kola (*Centella asiatica* (L.) Urb.) extract to inhibit acne-causing bacteria (*Propionibacterium acnes*) resulting from a literature review. This research method is a literature review or literature review. Research journals that met the inclusion criteria (activity test results suppressing bacterial growth activity) were collected, and a journal summary was made. A summary of the research journals is included in the table sorted by the year of publication of the journal. Based on the results of a literature review carried out by researchers, Gotu kola can be extracted using the maceration method by soaking the plant material in an extraction solvent such as ethanol or water for a specified time. This process was used to remove the active components from the plant material. The inhibition zone formed was evaluated to determine the effectiveness of the extracts or preparations containing gotu kola extract in preventing bacterial growth. Antibacterial power was tested using agar media inoculated with *Propionibacterium acnes*, and extracts or preparations were added using the diffusion method. From the literature review, it can be concluded that antioxidants and other bioactive substances contained in gotu kola extract can inhibit the growth of *Propionibacterium acnes*. This was shown based on the negative control not suppressing bacterial growth activity, while the cream containing gotu kola extract at a concentration of 5% had an inhibitory power of 17.3 mm.

**Keywords:** Gotu kola, extracts, antiacne, *Propionibacterium acne*

### INTRODUCTION

Acne is a skin condition that teens frequently experience. Inflammation of the skin in the form of an accumulation of oil and bacteria that clog the pores characterizes acne, a disorder that affects the sebaceous follicles (hair follicles, the base of the hair, and sebaceous glands). As a result, the pores widen and become clogged, resulting in pimples (Ramadhan *et al.*, 2021). Since *Staphylococcus aureus* and *Propionibacterium acne* are bacteria that frequently cause acne or affect the skin, it has been discovered that incorrect therapy is being used in the community to treat these bacteria. Antibacterial agents such as antiseptics and antibiotics are used instead, but their use must be carefully considered because of potential side effects like antibiotics and antiseptics. Their use must undoubtedly be closely monitored for side effects and resistance. Since the effect is less dramatic, we require natural

components that the body can readily handle. The solution to this issue may be found in natural components with antibiotic activity, such as gotu kola (*Centella asiatica* (L.) Urb.).

One of the most often utilized medicinal herbs in the area is *Centella asiatica* (L.) Urb. Asiaticoside, asiatic acid, and madecassic acid are present in gotu kola and can aid in wound healing. In order to repair and renew the skin when skin damage from acne occurs, the asiaticoside present in gotu kola can help speed up and induce the growth of collagen in the skin (Budi & Rahmawati, 2020). By rebuilding skin tissue, gotu kola leaf extract can accelerate the healing of acne-related inflammation (Yoscar & Edityaningrum, 2023). Gotu kola increases collagen synthesis in the skin tissue, stimulates intracellular fibroblast proliferation, increases the tensile strength of newly created skin, and suppresses the inflammatory phase in hypertrophic dermatitis (Hastuti *et al.*, 2019).

*Centella asiatica* (L.) Urb. contains saponin glycosides with pentacyclic triterpenoid aglycone groups, collectively referred to as centelloids. Asiaticoside, centeloside, madecassoside, brahmoside, brahminoside, thankuniside, sceleffoleoside, centellose, asiatic, brahmic, centellic, and madecassic acids are terpenoids that belong to this group. Triterpene saponins are typical secondary metabolites produced by the isoprenoid pathway and contain hydrophilic sugar chains in the form of glycones within the hydrophobic triterpenoid structures (aglycones). These qualities have been linked to the biological action of saponins (James & Dubery, 2009; Nurrosyidah *et al.*, 2019). Centelloids, a class of triterpenoid saponins, are the most significant component of gotu kola. Saponins make up approximately 1–8% of the total gotu kola ingredients. Ursane- and oleanane-type pentacyclic triterpenoid saponins are primary centellosides (Fernenda *et al.*, 2022). Alkaloids, saponins, tannins, flavonoids, steroids, and triterpenoids are components of gotu kola plants that are used as active ingredients in cosmetic preparations (Juliadi & Juanita, 2002; Sutardi, 2016). According to Agfadila *et al.* (2017) and Mardhiyah & Rosalina (2023), the active components in gotu kola extract affect bacterial growth, which inhibits the growth of *Staphylococcus aureus*, *Proteus vulgaris*, and *Escherichia coli*.

The purpose of this writing is to provide information about gotu kola (*Centella asiatica* (L.) Urb.), which can be used as an anti-acne, anti-inflammatory, and antioxidant agent. Bioactive substances contained in gotu kola extract can inhibit the growth of *Propionibacterium acnes*. This was shown based on the negative control not suppressing bacterial growth activity, while the cream containing gotu kola extract at a concentration of 5% had an inhibitory power of 17.3 mm.

## RESEARCH METHOD

The article preparation method used literature reviews from international and national journals. Search for published articles online via the sites PubMed, ResearchGate, Elsevier, EUDL, Google Scholar, MDPI, Nutrients, Pharmascope, David Publishing, ACS Publication, Scienceline Publication, and BiomedCentral. The keywords chosen were gotu kola, gotu kola leaves, gotu kola herb compounds, gotu kola extract content, the pharmacological activity of gotu kola, the antibacterial activity of gotu kola, the anti-acne activity of gotu kola extract. This review uses a literature review of research articles from 2002-2023 on the topic of gotu kola extract in the form of published articles in PDF format. The researchers found 112 articles that matched these keywords, consisting of 84 international journal articles and 28 Indonesian journal articles. Next, a selection was carried out and 31 articles were selected for review. Exclusion criteria for this study are the different extraction and maceration methods of gotu kola (*Centella asiatica* (L.) Urb.). The inclusion criteria for this study were the results of testing the inhibitory activity of *Propionibacterium acnes* bacteria using the diffusion test method.

## RESULTS AND DISCUSSION

One of the biodiversity that has the potential to be developed as a traditional medicine is gotu kola leaves (*Centella asiatica* (L.) Urb.). This plant originates from tropical Asia and spreads across Southeast Asia, including Indonesia, India, the People's Republic of China,

Japan, and Australia. Gotu kola is a wild plant that often grows on plantations, roadsides, or fields. One of the benefits that can be obtained from this plant is its antibacterial properties (Fatimah *et al.*, 2022).

According to several studies, the method of extracting gotu kola leaves (*Centella asiatica* (L.) Urb.) can be performed using several methods. One of the most commonly used methods is the maceration method, in which the plant material is immersed in a solvent such as ethanol or water for a certain period of time to extract the active compounds. Another method is soxhletation, which involves continuous solvent and condenser extraction. Other methods include ultrasonic-assisted extraction, microwave-assisted extraction, and extraction with supercritical fluids (Malik *et al.*, 2022).

Several studies have used the soxhletation method for the preparation of gotu kola (*Centella asiatica* (L.) Urb.) ethanol extract. The soxhletation method was performed using a soxhlet apparatus at a temperature of 60–80°C. Gotu kola powder was extracted with 96% ethanol until the active substance in the simplicia was completely extracted. The liquid obtained from soxhletation was then evaporated using a rotary evaporator at 60°C (Nurrosyidah *et al.*, 2019). In addition, extraction can be performed using the maceration method with 96% ethanol solvent. In this method, crushed or mashed plant material is soaked in ethanol for some time. This soaking process allowed the active compounds in the plant to dissolve in the ethanol solvent. The extract was then obtained by separating the solids from the solvent by filtration or extortion. The macerated macerate was evaporated using a rotary evaporator, followed by a water bath to obtain a thick extract (Awaluddin *et al.*, 2022).

Testing as an anti-acne on the ethanol extract gel preparation of gotu kola was carried out using an antibacterial test by determining the zone of inhibition of the growth of *Staphylococcus aureus* bacteria. The ethanol extract was also tested at various concentrations to determine the zone of bacterial growth inhibition. The results of this antibacterial test can be used as an indicator of the effectiveness of gotu kola ethanol extract gel preparations as anti-acne agents (Nurrosyidah *et al.*, 2019). *Propionibacterium acnes* is often associated with acne development. The antibacterial activity test can be carried out using the diffusion method, in which the extract or preparation to be tested is placed on agar media inoculated with *Propionibacterium acnes*. The inhibition zone formed was measured to evaluate the effectiveness of the extract or preparation in inhibiting bacterial growth (Awaluddin *et al.*, 2022).

Gotu kola (*Centella asiatica* (L.) Urb.) has been studied for its potential as an antiacne. Gotu kola extract contains bioactive compounds such as asiaticoside, which has been found to inhibit the growth of *Propionibacterium acnes*, the bacteria responsible for acne (Budi & Rahmawati, 2020). Another study proved that a cream preparation of gotu kola extract with a concentration of 5% had an inhibition of 17.3 mm, the negative control (cream base) did not show inhibitory activity against bacterial growth (Sukirawati & Khouw, 2023). According to Soebagio *et al.* (2020), the ethanol extract of gotu kola leaves at a concentration of 20% has an inhibition zone area against *Propionibacterium acnes* bacteria that has the same value as that of clindamycin (6.0755 cm<sup>2</sup>). By rebuilding skin tissue, gotu kola leaf extract can accelerate the healing of acne-related inflammation (Yoscar & Edityaningrum, 2023) caused by *Staphylococcus aureus* (Siregar *et al.*, 2022), *Propionibacterium acne* and *Staphylococcus aureus* (Khairiah *et al.*, 2020), *Propionibacterium acnes* and *Staphylococcus aureus*, *Propionibacterium acnes* (Jatmiko *et al.*, 2022), *Staphylococcus aureus* (Fatimah *et al.*, 2022), and *Staphylococcus aureus* and *Escherichia coli* (Wulansari *et al.*, 2023). Research on the inhibitory activity in gotu kola plant extract (*Centella asiatica* (L.) Urb.) which is formulated into dosage forms, is listed in Table I.

**Table I. List of Research on the Antibacterial Activity of Gotu Kola Extract Preparations (*Centella asiatica* (L.) Urb.)**

No	Title	Author	Method	Result
1	The Antibacterial and Antioxidant Activity of <i>Centella asiatica</i> Chloroform Extract-loaded Gelatin Nanoparticles	(Kesornbuakao <i>et al.</i> , 2018)	<i>Centella asiatica</i> extract-loaded gelatin nanoparticles at different ratios (1:2, 1:3, and 1:4 w/w) were added on MHA plates which were swabbed with bacterial cultures was referred to the modified agar well diffusion method.	<i>Centella asiatica</i> extract-loaded gelatin nanoparticles on ratio 1:4 has antibacterial activity more affected to gram-negative ( <i>E. coli</i> , <i>S. enterica</i> ) than gram-positive bacteria ( <i>B. cereus</i> , <i>B. subtilis</i> , and <i>S. aureus</i> ).
2	Uji Aktivitas Antibakteri Sediaan Gel Ekstrak Etanol Pegagan ( <i>Centella asiatica</i> L.) Terhadap Bakteri <i>S. aureus</i> Secara In Vitro	Nurrosyidah <i>et al.</i> (2019)	Gotu kola extract gel preparations with concentrations of 0.5%, 2.5% and 5% were tested in vitro using the agar diffusion method.	The ethanol extract gel preparation of gotu kola with a concentration of 5% has a strong inhibitory power of up to 25 mm against <i>S. aureus</i> .
3	Aktivitas Secara In Vitro dan In Vivo Kombinasi Ekstrak Daun Kelor ( <i>Moringa oleifera</i> lam.) dan Pegagan ( <i>Centella asiatica</i> (L.) Urb.) Sebagai Gel Anti Jerawat	(Hastuti <i>et al.</i> , 2019)	The antibacterial test against the growth of <i>Propionibacterium acnes</i> bacteria was carried out using the disc and hole cup method.	Powder and gel extracts, a combination of Moringa leaf extract and gotu kola herb, have antibacterial activity against <i>Propionibacterium acnes</i> .
4	Aktivitas Antibakteri Sediaan Sabun Wajah Cair Ekstrak Herba Pegagan ( <i>Centella asiatica</i> (L.) Urban) terhadap Pertumbuhan <i>P. acnes</i> dan <i>S. aureus</i>	Soebagio <i>et al.</i> (2020)	Soap preparations containing 20%, 30% and 40% extracts were tested for antibacterial activity using the paper disc method.	Soap preparations with an extract concentration of 40% could inhibit the growth of <i>S. aureus</i> and <i>P. acnes</i> .
5	Preparation of <i>Centella asiatica</i> Loaded Gelatin/Chitosan/ Nonwoven Fabric Composite Hydrogel Wound Dressing with Antibacterial Property	(Wang <i>et al.</i> , 2021)	The sandwich-like composite hydrogel wound dressings were developed by intercalating nonwoven fabrics as the middle layer, gelatin and chitosan hydrogel loaded with <i>Centella asiatica</i> as the base materials.	The wound dressing excellent antibacterial activity against <i>Staphylococcus aureus</i> and <i>Escherichia coli</i> .
6	Formulasi dan Evaluasi Sediaan Sabun Cuci Tangan Kombinasi Ekstrak Etanol Kulit Jeruk Bali dan Pegagan	(Setiawan <i>et al.</i> , 2021)	Testing of the antibacterial activity of hand washing soap was carried out using the well method against <i>Staphylococcus</i>	The hand washing soap formula containing a combination of 0.1% grapefruit peel extract and 0.1% gotu kola extract has the best bacterial

No	Title	Author	Method	Result
	Sebagai Anti Bakteri		<i>aureus</i> bacteria, then measuring the diameter of the inhibition zone.	inhibitory power.
7	Gelatin/Chitosan Bilayer Patches Loaded with Cortex <i>Phellodendron amurense</i> /Centella asiatica Extracts for Anti-Acne Application	(Kuo <i>et al.</i> , 2021)	The antibacterial activity of the bilayer gelatin/chitosan patch was determined by using disk diffusion analysis.	The bilayer gelatin/chitosan patches containing 1 mg/mL of <i>Phellodendri amurenensis</i> and 2.4 mg/mL of <i>Centella asiatica</i> could release an effective dosage extracts to inhibit <i>P. acnes</i> growth.
8	Formulation and Test of Antibacterial Activity of Antiacne Patch Preparations of <i>Centella asiatica</i> Leaf Ethanol Extract Against the Growth of <i>Propionibacterium acnes</i>	(Awaluddin <i>et al.</i> , 2022)	The method used in testing antibacterial activity is the agar diffusion method.	The patch preparation of gotu kola leaf extract concentration of 9% had the greatest potential in inhibiting the growth of <i>Propionibacterium acnes</i> .
9	Efektivitas Nanoemulsi Gel Daun Pegagan ( <i>Centella asiatica</i> L.) Konsentrasi 25%, 50% Dan 75% Terhadap Ketebalan Biofilm Bakteri <i>Staphylococcus aureus</i> (In Vitro)	(Soegiharto <i>et al.</i> , 2022)	The antibacterial effect of gotu kola leaf nanoemulsion concentrations of 25%, 50%, and 75% against <i>Staphylococcus aureus</i> biofilm was determined by calculating the Optical Density using an ELISA-reader.	Gotu kola leaf nanoemulsion with a concentration of 75% has the most effective antibacterial effect in reducing the thickness of the <i>Staphylococcus aureus</i> bacterial biofilm.
10	Uji Aktivitas Antibakteri Krim Ekstrak Herba Pegagan ( <i>Centella asiatica</i> (L.) Urban) Terhadap <i>Propionibacterium acne</i>	(Sukirawati & Khouw, 2023)	Determination of the inhibitory power of gotu kola herb extract cream against <i>Propionibacterium acnes</i> was carried out using hole cup method.	Gotu kola herb extract cream can inhibit the growth of <i>P. acnes</i> , namely at a 5% concentration the inhibitory power is 17.3 mm and at a 10% concentration the inhibitory power is 11 mm.
11	Formulation And Evaluation Of <i>Centella asiatica</i> , L . Urban Gel Preparation As An Anti-Acne Agent	(Supriadi <i>et al.</i> , 2023)	Antimicrobial test of <i>Centella asiatica</i> extract gel against <i>P. acne</i> bacteria using the paper disc method.	<i>Centella asiatica</i> extract gel with concentrations of 5% and 10% could inhibit the growth of <i>P. acne</i> bacteria with activity in the strong category.



Gotu kola extract clearly has antibacterial activity against *Propionibacterium acnes*. In addition, gotu kola has anti-inflammatory properties that can help reduce the number of papules, pustules, and nodules associated with acne. Its ability to stimulate fibroblast proliferation and collagen synthesis can also aid in healing acne scars (Hastuti *et al.*, 2019). Evidenced by extracts of gotu kola (*Centella asiatica* (L.) Urb.) contains bioactive compounds, such as triterpenoid saponins, flavonoids, phenolic acids, triterpenic steroids, amino acids, and sugars. Triterpenoid saponins in gotu kola extract can inhibit cyclooxygenase and lipoxygenase enzyme activity, as well as inhibit the production of proinflammatory cytokines (Ratz-Lyko *et al.*, 2016). In addition, flavonoids and phenolic compounds in gotu kola have antilipoxygenase and antioxidant activities (George *et al.*, 2009). Clinical and experimental studies have also provided strong evidence for the wound healing activity of gotu kola and its bioactive component, asiatic acid. Gotu kola dan asiatic acid function in one or more stages of the skin repair process. Collectively, they exhibit tissue regeneration, cell migration, and wound repair activities by inhibiting the release of inflammatory mediators and migration of immune cells in the tissues, damaged tissue, fibroblast proliferation, extracellular matrix synthesis, and collagen (Diniz *et al.*, 2023).

Gotu kola (*Centella asiatica* (L.) Urb.) contained bioactive compounds with antibacterial properties. This plant has been used as a traditional medicinal plant since 1884. In addition, gotu kola has low toxicity and can be digested in the body. It has been proven that gotu kola extract gel preparations with a concentration of 5% are proven to be more stable and have good spreading power. In addition, asiaticoside content in gotu kola can accelerate collagen growth and repair skin damage caused by acne (Malik *et al.*, 2022). The European Medicines Agency has reported clinical studies on the effects of gotu kola. The recommended dosage per oral for a non-toxic product with no adverse or rare side effects is 60–180 mg per day. However, at higher doses, burning or skin irritation may occur after the injection or topical use. Additionally, occasional stomach upset and nausea have been reported after consuming the gotu kola extract. Overall, there is no reason for concern regarding the safety and good tolerability of oral gotu kola preparations in all studies, and no adverse effects were demonstrated from pharmacovigilance data (Idris & Nadzir, 2021).

Gotu kola (*Centella asiatica* (L.) Urb.) as an active ingredient in anti-acne gel preparations, is considered relatively safe. This plant has been traditionally used as a medicinal plant for centuries and has been used in various safety studies. Acute toxicity studies in animals have shown that gotu kola extract has low toxicity. In addition, gotu kola has been tested in subchronic and chronic toxicity studies, with results showing good tolerance. This shows that the use of gotu kola in gel preparations does not cause significant side effects in the body. However, each individual may react differently to certain ingredients including gotu kola. Therefore, before using gel preparations with gotu kola extract, it is recommended to perform a patch test on a small area of the skin to ensure that no allergic reactions or irritation appear (Sasanti *et al.*, 2012).

## CONCLUSION

Gotu kola (*Centella asiatica* (L.) Urb.) extract clearly showed antibacterial activity against *Propionibacterium acnes*. In addition, Centela also has anti-inflammatory properties that can help reduce the number of papules, pustules and nodules associated with acne.

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