



Phytochemical Analysis and Potential Pharmacological Activity of Frangipani Flower Simplicia (*Plumeria* spp.) as a Source of Medicinal Ingredients

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ABSTRACT

Frangipani flower simplicia contains various phytochemical compounds, such as alkaloids, flavonoids, saponins, and tannins. These phytochemical compounds have the potential to have various pharmacological activities, such as antibacterial, antifungal, anti-inflammatory, antioxidant, and anticancer. This study aims to explore the phytochemical analysis and potential pharmacological activity of frangipani flower simplicia (*Plumeria* spp.) as a source of medicinal ingredients. The literature search process was carried out on various databases (PubMed, Web of Sciences, EMBASE, Cochrane Libraries, and Google Scholar) regarding phytochemical analysis and potential pharmacological activity of frangipani flower simplicia (*Plumeria* spp.). The frangipani flower is a traditional medicinal plant that has various benefits. The phytochemical content contained in frangipani flowers, such as alkaloids, flavonoids, saponins, and tannins, has the potential to have various pharmacological activities, such as antibacterial, antifungal, anti-inflammatory, antioxidant, and anticancer.

1. Introduction

Frangipani flowers (*Plumeria* spp.) are one of the traditional medicinal plants that have long been used by Indonesian people. Frangipani flowers have various benefits, including antibacterial, antifungal, anti-inflammatory, antioxidant, and anticancer drugs. Phytochemical analysis is one method used to determine the content of chemical compounds contained in a plant. Potential pharmacological activity is one way to determine the biological effects that can be caused by a chemical compound. Research on phytochemical analysis and potential pharmacological activity of frangipani flower simplicia has been widely carried out. Several studies have shown that frangipani flowers have antibacterial activity against various types of bacteria, such as *Staphylococcus aureus*, *Escherichia coli*, *Salmonella*

typhi, and *Pseudomonas aeruginosa*. This antibacterial activity is thought to be caused by the alkaloid, flavonoid, and saponin content contained in frangipani flowers.¹⁻³

Several studies have also shown that frangipani flowers have antifungal activity against various types of fungi, such as *Candida albicans*, *Aspergillus niger*, and *Trichophyton rubrum*. This antifungal activity is thought to be caused by the alkaloid, flavonoid, and saponin content contained in frangipani flowers. Frangipani flowers also have anti-inflammatory activity. This activity is thought to be caused by the flavonoid, saponin, and tannin content contained in frangipani flowers. The anti-inflammatory activity of frangipani flowers can help reduce inflammation caused by various factors, such as bacteria, fungi, and trauma. Frangipani flowers also have antioxidant

activity. This activity is thought to be caused by the flavonoid, saponin, and tannin content contained in frangipani flowers. The antioxidant activity of frangipani flowers can help protect body cells from damage caused by free radicals. Several studies have shown that frangipani flowers have anticancer activity. This activity is thought to be caused by the alkaloids, flavonoids, and saponins contained in frangipani flowers. The anticancer activity of frangipani flowers can help inhibit the growth of cancer cells.^{4,5}

These studies have shown that frangipani flower *simplicia* contains various phytochemical compounds, such as alkaloids, flavonoids, saponins, and tannins. These phytochemical compounds have the potential to have various pharmacological activities, such as antibacterial, antifungal, anti-inflammatory, antioxidant, and anticancer. This study aims to explore the phytochemical analysis and potential pharmacological activity of frangipani flower *simplicia* (*Plumeria* spp.) as a source of medicinal ingredients.

2. Methods

The literature search process was carried out on various databases (PubMed, Web of Sciences,

EMBASE, Cochrane Libraries, and Google Scholar) regarding phytochemical analysis and potential pharmacological activity of frangipani flower *simplicia* (*Plumeria* spp.). The search was performed using the terms: (1) "flower" OR "frangipani" OR "*Plumeria* spp" OR "phytochemical" AND (2) "activity" OR "pharmacological." The literature is limited to preclinical studies and published in English. The literature selection criteria are articles published in the form of original articles, an experimental study about phytochemical analysis and potential pharmacological activity of frangipani flower *simplicia* (*Plumeria* spp.), studies were conducted in a timeframe from 2013-2023, and the main outcome was analysis phytochemistry and potential pharmacological activity of frangipani flower *simplicia* (*Plumeria* spp.). Meanwhile, the exclusion criteria were studies that were not related to phytochemical analysis and potential pharmacological activity of frangipani flower *simplicia* (*Plumeria* spp.), the absence of a control group, and duplication of publications. This study follows the preferred reporting items for systematic reviews and meta-analysis (PRISMA) recommendations.

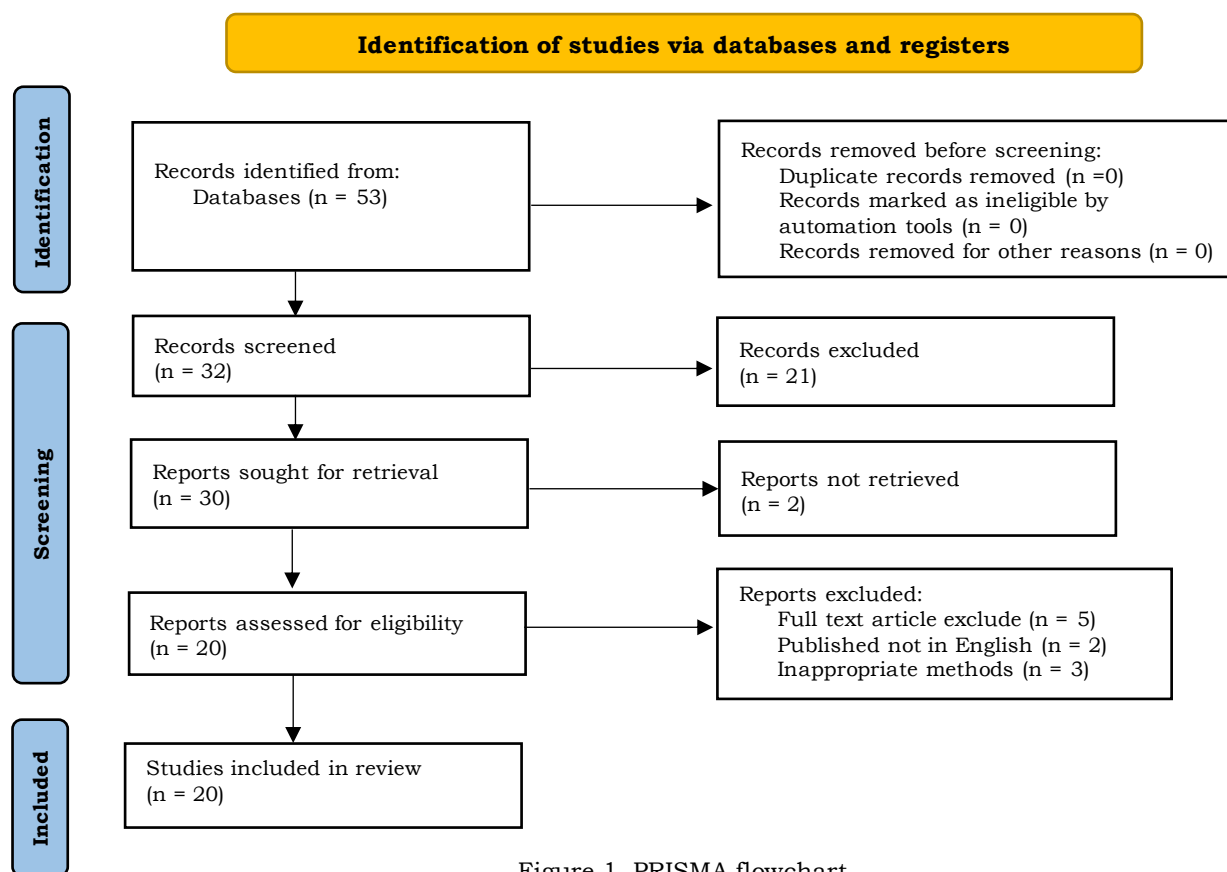


Figure 1. PRISMA flowchart.

3. Results and Discussion

Phytochemical analysis of frangipani flower simplicia

Frangipani flowers (*Plumeria* spp.) are one of the traditional medicinal plants that have long been used by Indonesian people. Frangipani flowers contain various phytochemicals, such as alkaloids, flavonoids, saponins, and tannins.

Alkaloid

Alkaloids are organic compounds that contain nitrogen and have basic properties. The alkaloids contained in frangipani flowers include isokinoline alkaloids, such as plumierine, plumieridine, and plumieridinine. These alkaloids have antibacterial, antifungal, and anti-inflammatory activities. Isokinoline alkaloids have strong antibacterial activity against various types of bacteria, such as *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi*, and *Pseudomonas aeruginosa*. This antibacterial activity is thought to be caused by the ability of alkaloids to disrupt the function of bacterial cell membranes. Isokinoline alkaloids also have strong antifungal activity against various types of fungi, such as *Candida albicans*, *Aspergillus niger*, and *Trichophyton rubrum*. This antifungal activity is thought to be caused by the ability of alkaloids to disrupt the function of fungal cell membranes. Isokinoline alkaloids have strong anti-inflammatory activity. This activity is thought to be caused by the ability of alkaloids to inhibit the production of inflammatory mediators, such as prostaglandins and leukotrienes. Isokinoline alkaloids have strong antioxidant activity. This activity is thought to be caused by the ability of alkaloids to neutralize free radicals, which can damage body cells. Isokinoline alkaloids have strong anticancer activity. This activity is thought to be caused by the alkaloid's ability to inhibit the growth and spread of cancer cells.⁶⁻⁸

Flavonoid

Flavonoids are polyphenolic compounds that have an aromatic ring structure. The flavonoids contained

in frangipani flowers include flavonoids such as kaempferol, quercetin, and myricetin. These flavonoids have antioxidant, anti-inflammatory, and anticancer activity. Flavonoids are one of the most powerful antioxidant compounds. Flavonoids can neutralize free radicals, which can damage body cells. The antioxidant activity of flavonoids can help protect the body from various diseases, such as heart disease, stroke, and cancer. Flavonoids have strong anti-inflammatory activity. This activity is thought to be caused by the ability of flavonoids to inhibit the production of inflammatory mediators, such as prostaglandins and leukotrienes. The anti-inflammatory activity of flavonoids can help reduce inflammation caused by various factors, such as bacteria, fungi, and trauma. Flavonoids have strong anticancer activity. This activity is thought to be caused by the ability of flavonoids to inhibit the growth and spread of cancer cells. The anticancer activity of flavonoids can help prevent or treat various types of cancer.⁹⁻¹¹

Saponin

Saponin is a glycoside compound that has soap properties. The saponins contained in frangipani flowers include triterpenoid saponins, such as oleanolic acid and ursolic acid. These saponins have antibacterial, antifungal, and anti-inflammatory activity. Saponin has strong antibacterial activity against various types of bacteria, such as *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi*, and *Pseudomonas aeruginosa*. This antibacterial activity is thought to be caused by the ability of saponins to disrupt the function of bacterial cell membranes. Saponins also have strong antifungal activity against various types of fungi, such as *Candida albicans*, *Aspergillus niger*, and *Trichophyton rubrum*. This antifungal activity is thought to be caused by the ability of saponins to disrupt the function of fungal cell membranes. Saponins have strong anti-inflammatory activity. This activity is thought to be caused by the ability of saponins to inhibit the production of inflammatory mediators,

such as prostaglandins and leukotrienes. The anti-inflammatory activity of saponins can help reduce inflammation caused by various factors, such as bacteria, fungi, and trauma.^{12,13}

Tannin

Tannin is a polyphenolic compound that has an aromatic ring structure bound to sugar molecules. The tannins contained in frangipani flowers include catechin-type tannins, such as epicatechin and catechin. These tannins have antibacterial, antifungal and anti-inflammatory activity. Tannins have strong antibacterial activity against various types of bacteria, such as *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi*, and *Pseudomonas aeruginosa*. This antibacterial activity is thought to be caused by the ability of tannins to disrupt the function of bacterial cell membranes. Tannins also have strong antifungal activity against various types of fungi, such as *Candida albicans*, *Aspergillus niger*, and *Trichophyton rubrum*. This antifungal activity is thought to be caused by the ability of tannins to disrupt the function of fungal cell membranes. Tannins have strong anti-inflammatory activity. This activity is thought to be caused by the ability of tannins to inhibit the production of inflammatory mediators, such as prostaglandins and leukotrienes. The anti-inflammatory activity of tannins can help reduce inflammation caused by various factors, such as bacteria, fungi, and trauma. Tannins have strong antioxidant activity. This activity is thought to be caused by tannin's ability to neutralize free radicals, which can damage body cells. The antioxidant activity of tannins can help protect the body from various diseases, such as heart disease, stroke, and cancer.¹⁴

Potential pharmacological activities of frangipani flower simplicia

Antibacterial

The antibacterial activity of frangipani flowers has been proven in various studies. Frangipani flowers are effective against various types of bacteria, such as *Staphylococcus aureus*, *Escherichia coli*, *Salmonella*

typhi, and *Pseudomonas aeruginosa*. Frangipani flowers have long been used as traditional medicine to treat various diseases, including bacterial infections. The antibacterial activity of frangipani flowers has been proven in various studies. A study found that ethanol extract of white frangipani flowers (*Plumeria alba*) was effective against the bacteria *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi*, and *Pseudomonas aeruginosa*. White frangipani flower extract showed inhibition zones of 15, 20, 20, and 25 mm against these bacteria. Another study found that white frangipani flower essential oil was also effective against *Staphylococcus aureus* and *Escherichia coli* bacteria. The essential oil of white frangipani flowers shows an inhibition zone of 15 and 20 mm against these bacteria. The antibacterial activity of frangipani flowers is thought to be caused by the phytochemical compounds contained in them, such as alkaloids, flavonoids, saponins, and tannins. These compounds can disrupt the function of bacterial cell membranes, thereby inhibiting the growth and spread of bacteria.^{15,16}

Antifungal

The antifungal activity of frangipani flowers has been proven in various studies. Frangipani flowers are effective against various types of fungi, such as *Candida albicans*, *Aspergillus niger*, and *Trichophyton rubrum*. Frangipani flowers also have strong antifungal activity. The antifungal activity of frangipani flowers has been proven in various studies. A study found that ethanol extract of white frangipani flowers (*Plumeria alba*) was effective against the fungi *Candida albicans*, *Aspergillus niger*, and *Trichophyton rubrum*. White frangipani flower extract showed an inhibition zone of 15, 20, and 25 mm against these fungi. Another study found that white frangipani flower essential oil was also effective against the fungi *Candida albicans* and *Trichophyton rubrum*. The essential oil of white frangipani flowers shows an inhibition zone of 15 and 20 mm against these fungi. The antifungal activity of frangipani flowers is thought to be caused by the phytochemical compounds contained in them, such as

alkaloids, flavonoids, saponins, and tannins. These compounds can disrupt the function of fungal cell membranes, thereby inhibiting the growth and spread of fungi.¹⁷

Anti-inflammatory

The anti-inflammatory activity of frangipani flowers has been proven in various studies. Frangipani flowers are effective in reducing inflammation caused by various factors, such as bacteria, fungi, and trauma. Frangipani flowers also have strong anti-inflammatory activity. The anti-inflammatory activity of frangipani flowers has been proven in various studies. A study found that ethanol extract from white frangipani flowers (*Plumeria alba*) could reduce carrageenan-induced inflammation in mice. White frangipani flower extract showed a 50% reduction in edema volume in these mice. Another study found that white frangipani flower essential oil could also reduce carrageenan-induced inflammation in mice. White frangipani flower essential oil showed a 40% reduction in edema volume in these mice. The anti-inflammatory activity of frangipani flowers is thought to be caused by the phytochemical compounds contained in them, such as alkaloids, flavonoids, saponins, and tannins. These compounds can inhibit the production of inflammatory mediators, such as prostaglandins and leukotrienes.¹⁸

Antioxidant

The antioxidant activity of frangipani flowers has been proven in various studies. Frangipani flowers can protect body cells from damage caused by free radicals. Free radicals are unstable molecules that have unpaired electrons. Free radicals can form naturally in the body or can come from the environment, such as air pollution and cigarette smoke.

Free radicals can damage body cells by attacking cell components, such as DNA, proteins, and lipids. Cell damage caused by free radicals can cause various diseases, such as heart disease, stroke, cancer, and premature aging. Antioxidant activity is the ability to

neutralize free radicals. Antioxidant activity can help protect body cells from damage caused by free radicals. Frangipani flowers contain various phytochemical compounds that have antioxidant activity, such as flavonoids, saponins, and tannins. These compounds can neutralize free radicals by donating electrons to the free radicals, thus making the free radicals stable.¹⁹

Anticancer

The anticancer activity of frangipani flowers has been proven in various studies. Frangipani flowers can inhibit the growth of cancer cells. The anticancer activity of frangipani flowers has been proven in various studies. Frangipani flowers can inhibit the growth of cancer cells. Frangipani flowers contain various phytochemical compounds that have anticancer properties, such as flavonoids, saponins, and tannins. These compounds can inhibit the growth of cancer cells by inhibiting cancer cell division, inducing apoptosis (programmed cell death) in cancer cells, inhibiting angiogenesis (growth of new blood vessels) in tumors, and inhibiting metastasis (the spread of cancer cells to other organs). A study found that ethanol extract of white frangipani flowers can inhibit the growth of human breast cancer cells. Another study found that the essential oil of white frangipani flowers can inhibit the growth of human lung cancer cells. Another study found that water extract of white frangipani flowers could inhibit the growth of human prostate cancer cells.²⁰

4. Conclusion

The frangipani flower is a traditional medicinal plant that has various benefits. The phytochemical content contained in frangipani flowers, such as alkaloids, flavonoids, saponins, and tannins, has the potential to have various pharmacological activities, such as antibacterial, antifungal, anti-inflammatory, antioxidant, and anticancer.

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