



Analysis of Compound Content of Ethanol Extract of Butterfly Pea Flower (*Clitoria ternatea* L.) Using Thin Layer Chromatography Method: A Systematic Literature Review

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ABSTRACT

The butterfly flower (*Clitoria ternatea* L.) is an herbal plant that is widely used in traditional medicine in Indonesia. The chemical compounds in butterfly pea flowers are thought to have various biological activities, such as antioxidant, anti-inflammatory, antibacterial and antidiabetic. Analysis of the compound content in butterfly pea flower extract can be done using various methods, one of which is thin layer chromatography (TLC). The literature search process was carried out on various databases (PubMed, Web of Sciences, EMBASE, Cochrane Libraries, and Google Scholar) analysis of the compound content of ethanol extract of butterfly pea flowers using the thin layer chromatography method. This study follows the preferred reporting items for systematic reviews and meta-analysis (PRISMA) recommendations. The ethanol extract of butterfly pea flowers contains various groups of secondary metabolite compounds, such as flavonoids, saponins, terpenoids and tannins. These compounds are thought to have various biological activities, such as antioxidant, anti-inflammatory, antibacterial and antidiabetic.

1. Introduction

The butterfly pea flower is an herbal plant that originated in South America but has now spread to various parts of the world, including Indonesia. This plant has the scientific name *Clitoria ternatea* L. and belongs to the Fabaceae family. Butterfly pea flowers have various benefits. As a food plant, butterfly pea flowers can be processed into various kinds of food and drinks, such as tea, syrup, and ice cream. As a natural dye, butterfly pea flowers can be used to color food, drinks, and fabrics. As a traditional medicine, butterfly pea flowers have various benefits, such as increasing body endurance, reducing inflammation, helping lower blood sugar levels, helping overcome insomnia, and helping to overcome stress. The

chemical compounds in butterfly pea flowers are thought to play a role in various biological activities. These compounds include flavonoids, such as quercetin and kaempferol, which have antioxidant, anti-inflammatory, and antibacterial properties. Saponins, such as triterpenoid saponins and steroid saponins, have anti-inflammatory, antibacterial, and antifungal activities. Terpenoids, such as anthocyanins and tannins, have antioxidant, anti-inflammatory, and anticancer properties.¹⁻³

Thin layer chromatography (TLC) is a method of separating compounds based on polarity differences. This method is carried out by dripping the sample solution onto a TLC plate that has been coated with a stationary phase. The stationary phase most often

used in TLC is silica gel. Then, the TLC plate is inserted into a vessel containing the mobile phase. The mobile phase used must have a different polarity from the stationary phase. The mobile phase most often used in TLC is a mixture of organic solvents. Compounds in the sample solution will move up the TLC plate at different speeds, depending on their polarity. More polar compounds will move slower, while less polar compounds will move faster. After the TLC plate is dried, the separated compounds can be observed using ultraviolet (UV) light or a dye. TLC is a simple, easy, and relatively cheap method. This method can be used to separate various types of compounds, including compounds contained in butterfly pea flower extract.⁴⁻⁶

2. Methods

The literature search process was carried out on various databases (PubMed, Web of Sciences, EMBASE, Cochrane Libraries, and Google Scholar) to analyze the compound content of ethanol extract of butterfly pea flowers using the thin layer

chromatography method. The search was performed using the terms: (1) "analysis" OR "content" OR "butterfly pea flower" OR "compound" AND (2) "chromatography" OR "TLC." The literature is limited to original studies and published in English. The literature selection criteria are articles published in the form of original articles, an experimental study about analysis of compound content of ethanol extract of butterfly pea flowers using thin layer chromatography method, studies were conducted in a timeframe from 2013-2023, and the main outcome was an analysis of compound content ethanol extract of butterfly pea flower using thin layer chromatography method. Meanwhile, the exclusion criteria were studies that were not related to the analysis of the compound content of ethanol extract of butterfly pea flowers using the thin layer chromatography method and duplication of publications. This study follows the preferred reporting items for systematic reviews and meta-analysis (PRISMA) recommendations.

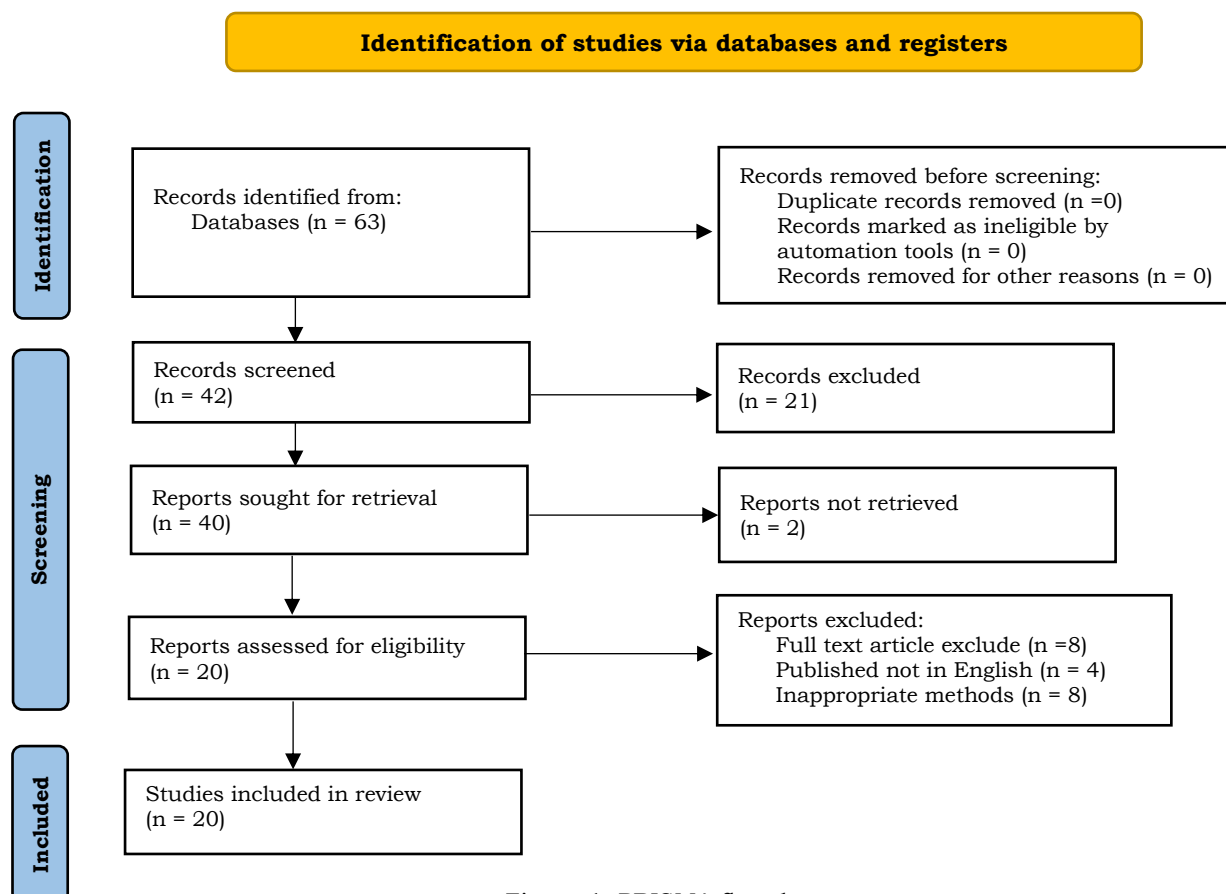


Figure 1. PRISMA flowchart.

3. Results and Discussion

Flavonoid

Flavonoids are a class of secondary metabolite compounds that are found in many plants, including butterfly pea flowers. Flavonoids have various biological activities, such as antioxidant, anti-inflammatory, and antibacterial. In the TLC examination, flavonoid compounds will appear yellow or green under ultraviolet (UV) light. This is because flavonoid compounds have flavonoid chromophores, namely a hydroxyl group (-OH) and a carbonyl group (C=O). This flavonoid chromophore will absorb ultraviolet light at certain wavelengths. This light absorption will cause the flavonoid compounds to appear yellow or green under ultraviolet light. The following are some examples of flavonoid compounds that can be found in the ethanol extract of butterfly pea flowers: Kaempferol, quercetin, myricetin, apigenin, and luteolin. These flavonoid compounds have various biological activities, such as antioxidants, flavonoids can protect cells from damage caused by free radicals. Free radicals are unstable molecules and can cause cell damage, such as premature aging, heart disease, and cancer. Anti-inflammatory: Flavonoids can reduce inflammation. Inflammation is the body's immune response to infection or injury. Antibacterial: Flavonoids can inhibit bacterial growth. Bacteria are microorganisms that can cause various diseases, such as respiratory tract infections and urinary tract infections. The discovery of flavonoids in the ethanol extract of butterfly pea flowers shows that butterfly pea flowers have the potential as a source of natural compounds that have various biological activities.⁷⁻¹¹

Saponin

Saponins are a class of secondary metabolite compounds that have detergent properties. Saponin can reduce the surface tension of water, so it can form foam. Saponins have various biological activities, such as: Anti-inflammatory: Saponins can reduce inflammation. Inflammation is the body's immune response to infection or injury. Antibacterial: saponin

can inhibit the growth of bacteria. Bacteria are microorganisms that can cause various diseases, such as respiratory tract infections and urinary tract infections. Antifungal: Saponin can inhibit the growth of fungus. Fungi are microorganisms that can cause various diseases, such as skin infections and digestive tract infections. In a TLC examination, saponin compounds will usually appear red or orange under ultraviolet (UV) light. This is because saponin compounds have steroid or triterpenoid groups. This steroid or triterpenoid group will absorb ultraviolet light at certain wavelengths. This light absorption will cause the saponin compound to appear red or orange under ultraviolet light. The following are some examples of saponin compounds that can be found in the ethanol extract of butterfly pea flowers: Triterpenoid saponins and Steroid saponins. The discovery of saponins in the ethanol extract of butterfly pea flowers shows that butterfly pea flowers have the potential to be a source of natural compounds that have various biological activities.¹³⁻¹⁶

Terpenoids

Terpenoids are a class of secondary metabolite compounds that have various structures and functions. Terpenoids consist of two basic units, namely isoprene. Terpenoids have various biological activities, such as antioxidants. Terpenoids can protect cells from damage caused by free radicals. Free radicals are unstable molecules and can cause cell damage, such as premature aging, heart disease, and cancer. Anti-inflammatory: Terpenoids can reduce inflammation. Inflammation is the body's immune response to infection or injury. Anticancer: Terpenoids can inhibit the growth of cancer cells. Cancer cells are cells that grow uncontrollably. In TLC examination, terpenoid compounds will usually appear yellow, orange, or red under ultraviolet (UV) light. This is because terpenoid compounds have hydrocarbon groups. This hydrocarbon group will absorb ultraviolet light at certain wavelengths. This light absorption will cause terpenoid compounds to appear yellow, orange, or red under ultraviolet light. The following are some

examples of terpenoid compounds that can be found in butterfly pea flower extract: Monoterpenoids, sesquiterpenoids, diterpenoids, triterpenoids, and tetraterpenoids. The discovery of terpenoids in butterfly pea flower extract shows that butterfly pea flowers have the potential to be a source of natural compounds that have various biological activities.¹⁷⁻²⁰

4. Conclusion

The ethanol extract of butterfly pea flowers contains various groups of secondary metabolite compounds, such as flavonoids, saponins, terpenoids, and tannins. These compounds are thought to have various biological activities, such as antioxidant, anti-inflammatory, antibacterial, and antidiabetic.

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