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Identification of Tannin, Triterpenoid, and Flavonoid Function Groups of Jamblang Plants (*Syzygium cumini*): A Systematic Literature Review

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A B S T R A C T

Identification of the functional groups of tannins, triterpenoids, and flavonoids in jamblang is important to determine the type and content of bioactive compounds found in jamblang. By knowing the type and content of these bioactive compounds, the potential of jamblang as a traditional medicine can be further optimized. This study aims to explore the identification of tannin, triterpenoid, and flavonoid functional groups in jamblang. The literature search process was carried out on various databases (PubMed, Web of Sciences, EMBASE, Cochrane Libraries, and Google Scholar) regarding the identification of tannin, triterpenoid, and flavonoid functional groups in jamblang (*Syzygium cumini*). This study follows the preferred reporting items for systematic reviews and meta-analysis (PRISMA) recommendations. Jamblang contains various types of tannins, including catechins, gallotanins, and proanthocyanidins. Jamblang contains various types of triterpenoids, including phytosterols, triterpenoid saponins, and other triterpenoids. Jamblang contains various types of flavonoids, including flavonols, flavanones, and anthocyanins.

1. Introduction

Jamblang (*Syzygium cumini* L.) is a fruit plant originating from South Asia and Southeast Asia. Jamblang has various health benefits, such as antibacterial, antifungal, antioxidant, anti-inflammatory, anticancer, antidiabetic, antihypertensive, and antidiarrheal. These benefits are thought to come from the bioactive compounds contained in jamblang. The most abundant bioactive compounds found in jamblang are tannins, triterpenoids, and flavonoids. Tannins are phenolic compounds that have water solubility properties and can form complexes with proteins. Tannins have various biological activities, such as antibacterial, antifungal, antioxidant, anti-inflammatory, and anticancer. Triterpenoids are terpenoid compounds that have three isoprene units. Triterpenoids have various biological activities, such as antibacterial, antifungal, antioxidant, anti-inflammatory, and anticancer. Flavonoids are phenolic compounds that have two benzene rings conjugated with one or more hydroxyl groups. Flavonoids have various biological activities, such as antibacterial, antifungal, antioxidant, anti-inflammatory, and anticancer.[1-3]

Identification of the functional groups of tannins, triterpenoids, and flavonoids in jamblang is important to determine the type and content of bioactive compounds found in jamblang. By knowing the type and content of these bioactive compounds, the potential of jamblang as a traditional medicine can be

further optimized. Tannins and flavonoids are generally water soluble, while triterpenoids are insoluble in water. Tannins can give a red or brown color to acid solutions, while flavonoids can give a yellow, pink, or blue color to acid solutions. Tannins can react with Fehling's or Benedict's reagent to form a brick-red precipitate. Triterpenoids can react with Liebermann-Burchard reagent to form a red or dark red color. Flavonoids can react with Shinoda's reagent to form a yellow color. Spectroscopic analysis, such as infrared spectroscopy (IR) and mass spectroscopy (MS), can be used to identify functional groups of tannins, triterpenoids, and flavonoids.[4-7] This study aims to explore the identification of tannin, triterpenoid, and flavonoid functional groups in jamblang.

2. Methods

The literature search process was carried out on various databases (PubMed, Web of Sciences, EMBASE, Cochrane Libraries, and Google Scholar) regarding the identification of functional groups of tannins, triterpenoids, and flavonoids in jamblang (*Syzygium cumini*). The search was performed using the terms: (1) "jamblang" OR "java plum" OR "*Syzygium cumini*" OR "tannin" AND (2) "triterpenoid" OR "flavonoid." 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 the identification of functional groups of tannins, triterpenoids, and flavonoids in jamblang (*Syzygium cumini*), studies were conducted in a timeframe from 2013-2023, and the main outcome was Identification of functional groups of tannins, triterpenoids, and flavonoids in jamblang (*Syzygium cumini*). Meanwhile, the exclusion criteria were studies that were not related to the Identification of functional groups of tannins, triterpenoids, and flavonoids in jamblang (*Syzygium cumini*), 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.

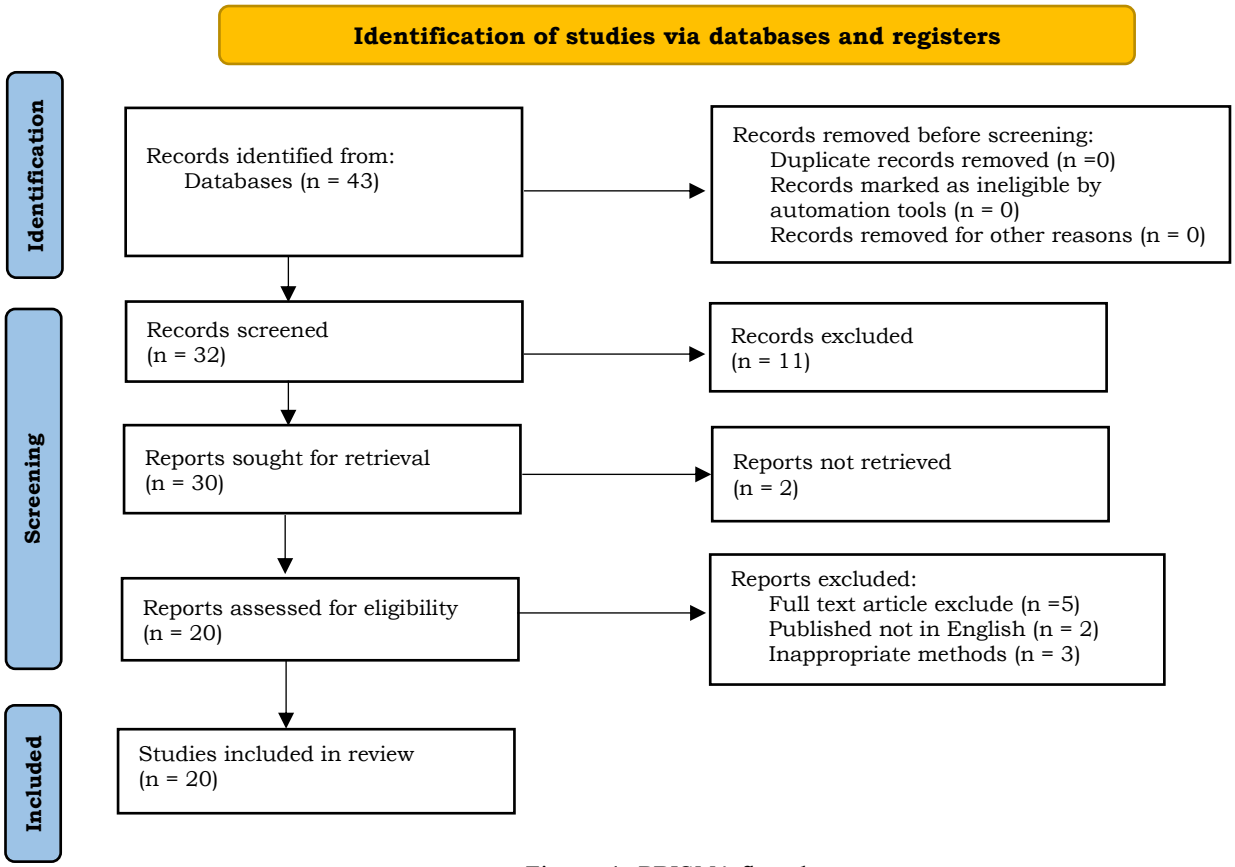

Figure 1. PRISMA flowchart.

3. Results and Discussion

Tannin

Catechins are polyphenolic compounds that have two hydroxyl groups on the benzene ring. Catechins are the most commonly found tannin compounds and are found in various fruits, vegetables, and drinks, including jamblang.

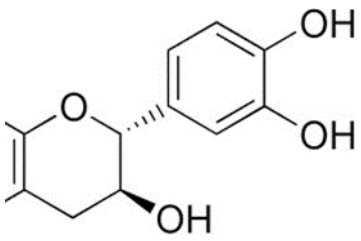

Figure 2. Chemical structure of catechin.

Catechins have a variety of beneficial biological properties, including antibacterial, antifungal, antioxidant, anti-inflammatory, anticancer, antidiabetic, antihypertensive, and antidiarrheal. Catechins work by inhibiting the growth and replication of bacteria and fungi, as well as by neutralizing free radicals that can damage cells. Catechins can also help reduce inflammation and improve immunity.[8-10]

Proanthocyanidins are tannin compounds consisting of two or more catechin units that are covalently bound. Proanthocyanidins are compounds commonly found in fruits, vegetables, and grains, including jamblang.[11,12]

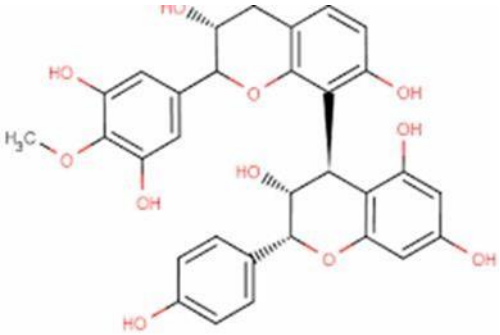

Figure 3. Chemical structure of proanthocyanidin.

Proanthocyanidins have a variety of beneficial biological properties, including antibacterial, antifungal, antioxidant, anti-inflammatory, and anticancer. Proanthocyanidins work by inhibiting the growth and replication of bacteria and fungi, as well as by neutralizing free radicals that can damage cells. Proanthocyanidins can also help reduce inflammation and improve immunity.[13]

Ellagitannin is a tannin compound consisting of catechin, gallotannin, and ellagic acid units. Ellagitannins are compounds commonly found in fruits, vegetables, and nuts, including pomegranates, berries, and jamblang. Ellagitannins have a variety of beneficial biological properties, including antibacterial, antifungal, antioxidant, anti-inflammatory, and anticancer. Ellagitannin works by inhibiting the growth and replication of bacteria and fungi, as well as by neutralizing free radicals that can damage cells. Ellagitannins can also help reduce inflammation and improve immunity.[14,15]

Triterpenoids

Steroids are triterpenoid compounds that have a lactam ring. Steroids in jamblang include phytosterols, such as β-sitosterol and stigmasterol.

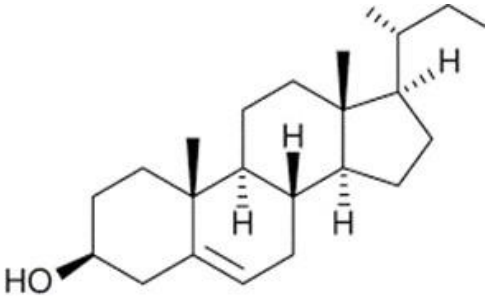

Figure 4. Chemical structure of phytosterols.

Phytosterols have various health benefits, including lowering LDL cholesterol levels, increasing HDL cholesterol levels, and reducing the risk of heart disease. Triterpenoid saponins are triterpenoid compounds that have a glycosidic group. Saponin triterpenoids in jamblang include oleanin, amyrin, and ursolic acid.[16]

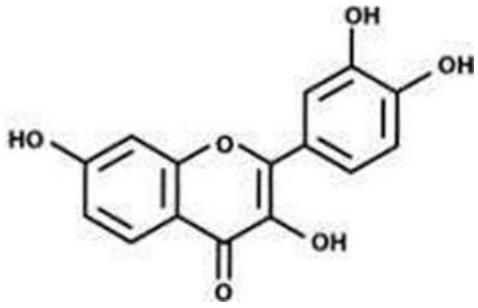

Figure 5. Triterpenoid saponin structure.

Flavonoid

Flavonols are flavonoids that have one benzene ring attached to a hexose ring with a single bond. Flavonoids are compounds commonly found in plants and have various health benefits, including antioxidant, anti-inflammatory, antibacterial, antifungal, and anticancer. Research has shown that jamblang contains various types of flavonoids, including quercetin, kaempferol, and myricetin. Quercetin is the most common flavonoid found in plants and has broad biological activities. Quercetin has strong antioxidant properties and can help protect cells from free radical damage. Quercetin also has anti-inflammatory, antibacterial, and antifungal properties. Kaempferol is a flavonoid that has strong antioxidant properties and can help protect cells from damage caused by free radicals. Kaempferol also has anti-inflammatory, antibacterial, and antifungal properties. Myricetin is a flavonoid that has strong antioxidant properties and can help protect cells from free radical damage. Myricetin also has anti-inflammatory, antibacterial, and anti-fungal properties.[17,18]

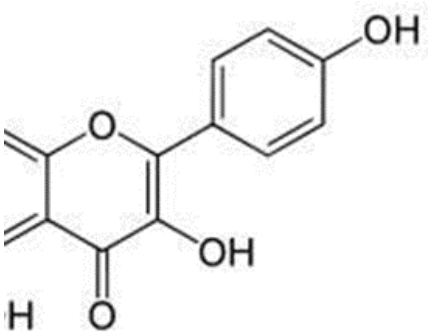

Figure 6. Flavonoid structure.

Flavanones are flavonoids that have two benzene rings attached to a hexose ring with a single bond. Flavonoids are compounds commonly found in plants and have various health benefits, including antioxidant, anti-inflammatory, antibacterial, antifungal, and anticancer. Research has shown that jamblang contains various types of flavonoids, including hesperidin and naringenin. Hesperidin is a flavonoid that has strong antioxidant properties and can help protect cells from free radical damage. Hesperidin also has anti-inflammatory, antibacterial, and antifungal properties. Naringenin is a flavonoid that has strong antioxidant properties and can help protect cells from free radical damage. Naringenin also has anti-inflammatory, antibacterial, and anti-fungal properties.[19,20]

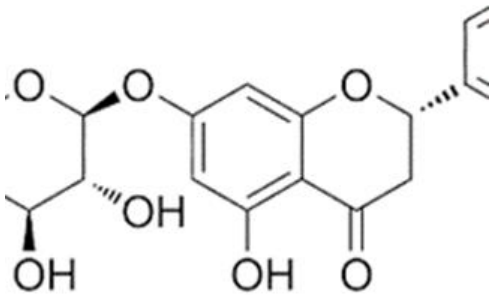

Figure 7. Flavanone structure.

4. Conclusion

Jamblang is a plant that is rich in bioactive compounds, including tannins, triterpenoids, and flavonoids. These compounds have various health benefits, such as antioxidants, anti-inflammatory, antibacterial, antifungal, and anticancer.

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