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Phytochemical and the Effects Pharmocological of Mangosteen(*Garcinia mangostana L*) a : Review

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Abstract:
Background*: Mangosteen is a fruit plant in the form of a tree originating from tropical forests in Southeast Asia, generally found in India, Malaysia and Indonesia. Traditionally, the mangosteen fruit is a cure for thrush, hemorrhoids and wounds. Mangosteen, nicknamed "Queen of Fruits" has a distinctive sweet and sour taste. Phytochemicals of mangosteen rind, flesh and seeds contain tannins and xanthones. Mangosteen seeds contain vitamin C. Fully ripe fruit contains xanthone, gartanin, 8-disoxygartanin and normagastin compounds which have anti-cancer, anti-inflammatory, antimicrobial, antifungal, antioxidant and pharmacological activities.*
Materials and Methods*: The preparation of this article review uses techniques in literature study by looking for theoretical references that are relevant. Collecting National and International Articles with a span of 10 years. In this article review using online media such as PubMed, ScienceDerect and Researchgate with the search keywords Garcinia mangostana L., phytochemical, pharmacology.*
Results*: In this review article, mangosteen contains phytochemicals in the form of xanthones, phenols, a-mangosteen, y-mangosteen and has anti-cancer, anti-inflammatory, antimicrobial, antifungal, antioxidant properties.*
Conclusion: *In general, mangosteen has been widely used in traditional medicine because of its phytochemical content that has pharmacological effects with various processing methods from various types of plant parts used, such as leaves, fruit skin, resin, and fruit.*
Key Word*: Garcinia mangostana L., phytochemical, pharmacology*

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I. Introduction

Indonesia is a country rich in medicinal plants[1]. Traditional medicine is being widely discussed in medical circles and the public because it has an economical price and often causes small side effects compared to long-term synthetic treatments such as toxicity. because it has a lot of phytochemical content found in plants[2]. As many as 100,000 people die in the United States each year due to synthetic drug poisoning where the death rate is higher than for drunk drivers[3],[4].

Mangosteen belongs to the Clusiaceae family which is commonly found in Asia[5]. Mangosteen is traditionally used to treat various types of diseases including diarrhea, dysentery, cholera, fever, inflammation[6][7], cholesterol reduction [8], antioxidants [9],cytotoxic [9],[10], and antidiabetic [8],[11],[12].

Figure 1. Garcinia Mangostana L.

Mangosteencontains primary and secondary metabolites. The content of primary metabolites is identified as sugars, organic acids, amino acids, alcohols, aldehydes, glycosides, and fatty acids. The secondary metabolites contained in mangosteen are Xanthones, especially α-mangosteen and γ-mangosteen [13], benzophenone, biflavonoid, flavonoid [14].

II. Methods

In compiling this review article, the technique used is to use a literature study by searching for sources or literature in the journals in the last 10 years. The main reference searches used in this review article are through trusted websites such as PubMed (145), ScienceDirect (13) and Researchgate (210).

III. Result

Phytochemicals *Garcinia mangostana*L.

*Garcinia mangostana*L has phenolic compounds, flavonoids,and tannins; and the main ones are isoprenylated xanthones compounds which are better known as mangosteens. Xanthone compounds such as α-mangostinγ-mangostin,β-mangostin 8-deoxygartanine, gartanine and garcinones C and D. There are two active compounds in the pericarp of the fructus *Graciniamangostin*namely garcinone E and gartinin can be obtained by several extraction methods. [15].

Table 1. Activity of mangosteen fruit (*Garcinia mangostana,* L.)

No	Active Compound	Plant Parts	Extraction Method	Solvent	Results	Ref
1.	Xanthone	Folium	Maceration	Water	Anticancer Melanoma cell (B16F1)	[16]
		Pericarp fructus	Maceration	n-hexan,	Antioxidant	[8]
		Pericarp fructus	Maceration	Methanol 96% 1:1	Anti-inflammatory	[17]
2	Phenol	Folium and pericarp fructus	Dekocta	Methanol 80% and water	Antimicrobial on gram positive and negative bacteria	[18]
		resin, folium and pericarp	Maceration	Ethanol 70%	antimicrobial against *Stapylococcus aureus* and *Escherichia coli* bacteria and antitumor	[19]
		Pericarp fructus	Filter paper (whatman)	Ethanol 70%	Antibacterial on F. columare	[20]
3.	α-mangostin	Pericarp fructus	Infusion	Water	Antioxidant	[11]
		Pericarp fructus	Maceration	Ethanol 80%	Anti-fungal colletotrichum gloeosporioide	[21]
		Pericarp fructus	Maceration	Ethanol 95%	Anticancer in a cell CNE-2	[22]
4.	γ-mangostin	Pericarp fructus	Maceration	Methanol	Antioxidant	[23]

Anti-cancer

Mangosteen leaf extract can increase melanogenesis in B16F1 melanoma cells. Melanin secretion increases with increasing dose. This is due to the high antioxidant content in mangosteen leaves. The melanogenic activity of mangosteen leaf extract is stronger on the content and secretion of total melanin than melanin-stimulating hormone (MSH)[16].Mangosteen contains xanthones as an active compound that has the potential to treat and prevent cancer. This mangosteen extract can induce apoptosis of CNE-2 cells as part of a cancer treatment method[17]

Anti-inflammatory

Pericarp Fructus *Garcinia mangostana*as anti-inflammatory. Gel preparations *Graciniamangostana*are effective as an anti-inflammatory. The mechanism of anti-inflammatory action of *Garcianamangostana*is by inhibiting the cyclooxygenase (COX) enzyme in the arachidonic acid pathway, which results in a decrease in inflammation. Xanthones play a role in inhibiting inflammation through the NF-κB signaling cascade[18].
Other studies have found that mangosteen contains several identical components as nonsteroidal anti-inflammatory drugs / anti-inflammatory agents that target COX enzymes [19]. Inflammatory mediators are inhibited by xanthones, G*raciniamangostana*has an anti-inflammatory effect[20].

Antimicrobial

The activity produced by extracts of 70% ethanol and 80% methanol on the resin, pericarp of fruit and leaves of G*raciniamangostana L* with maceration and decoction methods were effective as gram-positive and negative antimicrobials including *Stapylococcus aureus, Escherichia coli and* monocytogenes[21],[22].

Inhibition of microbial growth can be attributed to the presence of compounds phenolics in plants [23].Another study reported that the ethanolic extract of *Graciniamangostana*L had antibacterial activity against methicillin-resistant *Staphylococcus aureus*[24].

Antifungal

The plant *Graciniamangostana*is used traditionally to prevent fungal infections, the part used is pericarp fructus by ultrasonic extraction method at a temperature of 50^{oC}. α-Mangostin showed better inhibitory effect on spore germination. Further ultrastructural observations revealed that α-Mangostin caused a decrease in the quantity and shape of mitochondrial swelling in C gloeosporioides mycelium cells. These results indicate that the mode of action of α-Mangostin causes the destruction of mitochondrial energy metabolism [25]. The juice and leaf extract of G*raciniamangostana*L is effective against the fungus *Saccharomyces cerevisiae* [26].

Antioxidant

Antioxidants are substances that inhibit the negative effects of free radicals, the content of which is an antioxidant from the mangosteen plant is xanthones. The content of this mangosteen rind extract showed a significant effect on reducing serum MDA (malondialdehyde) levels in mice. MDA is one of the end products of the peroxidation of unsaturated fatty acids in cells, where its concentration can be used as an indicator of cell/tissue damage[8]. The highest xanthone content in mangosteen rind as an antioxidant is mangosteen[11]. γ-mangosteen is effective in inhibiting the formation of lipid peroxides according to the concentration used[27]. Methanol extract from a maceration of pericarp fructus also significantly reduces monoamine oxidase levels which have a potential neuroprotective effect [28]

IV. Conclusion

In general, mangosteen has been widely used in traditional medicine because of its phytochemical content such as xanthones, phenols, α-mangosteen, γ-mangosteen which have pharmacological effects including anti-cancer, anti-inflammatory, antimicrobial, antifungal, antihyperlipidemic, and antihyperglycemic from various processing methods from the plant parts used. , such as leaves, fruit skin, resin, and fruit.

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