International Journal of Medical and Pharmaceutical Sciences
Open access peer-reviewed Journal
Volume 2, Issue 4, Page 45-50.
https://doi.org/10.5281/zenodo.19473462

Review Article

A Review on Hibiscus Rosa-Sinensis: Phytochemistry and Medicinal Uses

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The China rose, or Hibiscus rosa sinensis, is a member of the Malvaceae family. In many tropical nations, this plant is used medicinally to treat wounds, inflammation, fever, coughs, diabetes, bacterial and fungal infections, hair loss, and stomach ulcers. According to phytochemical study, flavonoids, tannins, terpenoids, saponins, and alkaloids are the primary bioactive substances that give it its therapeutic effects. Recent research revealed that a variety of extracts from every part of H. rosa sinensis demonstrated a broad range of advantageous effects, including anti-pyritic, anti-inflammatory, anti-cancer, antioxidant, anti-bacterial, anti-diabetic, wound healing, and abortifacient properties. According to histological research, the majority of extracts from all parts of this plant did not demonstrate any indicators of toxicity at higher doses, according to the few toxicity tests. Some of the extracts did, however, change hematological and biochemical markers. As a result, more investigation is needed to separate the phytochemicals and investigate their precise mode of action. In order to identify research gaps and explore the flower's therapeutic potential through clinical trials, this review outlines the phytochemistry, pharmacology, and medicinal uses of this flower.

Keywords: Hibiscus, Malvaceae, Medicinal uses, Phytochemicals, Therapeutic potential.

INTRODUCTION

The China rose, also known as Hibiscus Rosa Sinensis of the Hibisceae tribe and family Malvaceae, is a prominent evergreen shrub that grows in the Middle East and Eastern Asia. 1 Native to China and India, H. Rosa-Sinensis Linn is a powerful medicinal plant that is utilized as "Zhujin" in traditional Chinese medicine. In particular, this plant is known by a variety of names, including "Japa" or Japapushp, "Arkapriya" in Sanskrit, "Shoe flower" in English, "Jasund" in Hindi, "Angharee-hind" in Persian, and "Wadamal" in Sinhalese. Plantae-Kingdom, Magnoliopsida-Class, Spermatophyta-Phylum, Angiospermae-Subphylum, Malvales-Order, Malvaceae-Family, Hibiscus-Genus, and Rosa Sinensis-Species are the taxonomic divisions for Hibiscus Rosa Sinensis. This plant's entire portion has enormous nutritional and medicinal value. Hibiscus Rosa Sinensis flowers are edible, lack flavor, can be used as a substitute for spinach in some areas, are mucilaginous and fibrous, and can be used as a dye to add color to preserved fruits and rustle-up vegetables. 2,3 The plant hibiscus is used in Ayurvedic medicine to cure cold, wound healing, irritated and/or injured tissue, and integument regeneration. Temperatures above 11°C cause serious leaf damage, slowed growth, and plant mortality. In an effort to prevent the extinction of this significant species, Hibiscus rosa-sinensis was improved through somatic hybridization with the frost-tolerant Lavatera Thuringia. The stunning flowering plant Hibiscus rosa sinensis, which is primarily found in southeast China and a few islands in the Pacific and Indian Oceans, is frequently referred to as "China rose" or "Queen of tropics." One of Hawaii's beloved national plants, hibiscus is frequently worn in hair during cultural events. This plant is a vascular plant that produces seeds since it is a member of the class Magnoliopsida and the subkingdom Magnoliophyta. It is one of the

300 species in the genus Hibiscus and a member of the family Malvaceae.

Classification and Botany

Hibiscus rosa-sinensis is a member of the phylum "Magnoliophyta" because it is a flowering plant with true leaves, stems, and roots as well as carpels enclosing ovules. It is also a member of the "class" Magnoliopsida because it is a eudicot, which means that it flowers in groups of four or five, its leaves have netlike viens, and its seeds have two cotyledons. Additionally, it belongs to the order "Malvalves" since the flower's petals overlap, it has several stamens, and its phloem is made up of fibers that result in a tougher bark. It is also a member of the "Malvaceae" family because it is typically found as small trees or bushes with bristly pollen in almost every geographic location, with the exception of very cold climates. Finally, the genus "Hibiscus," which has over 250 native species, includes the H. rosa sinensis species. Hibiscus rosa-sinensis grows in little trees known as "shrubs," which are typically 4 meters tall, evergreen, and have oval branches with 10 cm broad and 15 cm long stalks. The flowers are generally found on long stalks, are about 20 cm wide, and have five smooth-edged, round, whorled petals that are joined at the base to the central stamina column. This central column is coated in many yellow anthers and has a style with five lobes at the tip.

Phytochemistry of Hibiscus rosa-sinensis:

Numerous chemicals can be found in every region of H. rosa sinensis. According to reports, leaves, flowers, stems, and roots include phlobatannins, glycosides, saponins, flavonoids, terpenoids, and other substances like thiamine, riboflavin, and niacin. The pharmacological effects of the plant were attributed to the presence of glucosides, flavonoids, phytosterols, terpenoids, tannins, and phenolic compounds in all four morphotypes of H. rosa sinensis, according to Patel and Adhav's study. This implied that the phytochemical compositions were relatively comparable despite the differences in blossom hue. These results are also consistent with another study that used thin-layer chromatographic analysis. Moisture, nitrogen, fat, crude fiber, calcium, phosphorus, and iron are typically found in edible flowers. Numerous flavones, including cyanidin-3,5-diglucoside and cyaniding-3-sophoroside, are present in the yellow blossoms. 3-5 glucoside Quercetin-3,5-diglucoside and 3,7-diglucoside. White flowers include kaempferol-3-xylosylglucoside isolate, among other chemicals. Along with fatty acids, fatty alcohols, and hydrocarbons, the leaves also include gentisic acid, mucilage, catalase, and around 7.34 mg of carotene per 100 grams. Conversely, root bark contains cyclopropenoids. All parts of Hibiscus rosa sinensis contain quercetin, despite the fact that flowers, stems, and leaves have trace levels of cyanin and cyanidin chorides. However, only stems and leaves contain ß-sitosterol, teraxeryl acetate, and malvalic acids. Ethanimidic acid, ethyl ester, propanal, 2,3dihydroxy, propanamide, N ethyl-, ethylenediamine, O-methylisourea hydrogen sulfate, ethene, ethoxy-, hexadecanoic acid, and methyl ester were among the components found in methanol extracts of hibiscus flowers using mass spectrum GC-MS interpretations. 7-Formylbicyclo (4.1.0) heptanes, 2-Butanamine, (S)-, 1,3,5-Triazine-2,4,6-triamine, N-Formyl β-alanine, (Z)6, (Z)9-Pentadecadien-1-ol, Butanedial, 1-Propanol, 2 methyl-, and Methanecarbothiolic acid. These substances were demonstrated to possess anti-cancer, antioxidant, pesticide, hypocholesterolemic, dermatitigenic, and anemiagenic qualities. Additionally, Propanal, 2,3-dihydroxy, Ethylenediamine, o-Methylisourea hydrogen sulfate, 2-Butanamine, (S), (Z) 6,(Z) 9-Pentadecadien-1-ol, and 1-Propanol, 2-methyl-all have antibacterial and antioxidant properties. A recent investigation on the antioxidant benefits of H. rosa sinensis revealed a substantial link between the extracts' flavonoids, phenolics, and anthocyanins and antioxidant activity. This demonstrated that the observed antioxidant activity was caused by these compounds. Anthocyanins have unique natural coloring qualities, but the majority of these phytochemicals have potential medical applications in the future, which will be covered in more detail in the following section. It was shown that the dye uptake process of cotton and silk fabrics was improved in comparison to the controlled sample in terms of fastness when metal mordants including Cu, Sn, and Al were combined with Hibiscus rosa sinensis anthocyanin extract. Its previously indicated antioxidant activity may be the primary cause of this. Hibiscus rosa-sinensis flowers were also used to extract cyanidin-3-sophoroside, another chemical. It

was effectively employed as an indicator for a variety of acid-base titrations in this work, even using smaller amounts of acids and bases than the traditional indications like phenolphthalein and methyl orange. Furthermore, compared to manufactured pigments, natural pigments like cyanidin-3-Sophoroside are non-carcinogenic, eco-friendly, and biodegradable. The various plant extracts and their pharmacological effects are shown.

Medicinal Uses:

Class of Compound	Chemical Constituents	Medicinal Uses
Flavonoids	Quercetin, Kaempferol, Rutin, Myricetin	Antioxidant, anti-inflammatory, antihypertensive, anticancer
Anthocyanins	Delphinidin, Cyanidin	Antioxidant, anti-inflammatory, improves circulation, hypotensive effects
Phenolic Acids	Caffeic acid, Chlorogenic acid, Ferulic acid	Antioxidant, anti-inflammatory, antidiabetic
Tannins	Ellagic acid, Gallotannins	Antioxidant, antimicrobial, anti-inflammatory
Alkaloids	Hibiscine	Antihypertensive, mild sedative
Terpenoids	Triterpenes, Saponins	Anti-inflammatory, anticancer, antioxidant
Organic Acids	Citric acid, Malic acid	Antioxidant, mild analgesic, improves metabolism
Essential Oils	Eugenol	Antimicrobial, anti-inflammatory

Pharmacological Activities:

1. Antioxidant Activity

At a concentration of 50 µg/ml, the ethanolic (95.0%) floral extract significantly inhibited hydrogen peroxide for 96 ± 2.35%, whereas ascorbic acid, a common antioxidant, generated 76.33 ± 1.25% radical scavenging activity at a dosage of 100 µg/ml. According to a research, the majority of the chemicals found by GC-MS analysis were classified as alkaloids, tannins, steroids, glycosides, and flavonoids. These molecules may also be the cause of the significant radical scavenging action. The development of tissue damage is significantly influenced by free radicals, such as those produced by hydrogen peroxide. Any compounds that can eliminate them, like the phytochemicals found in H. rosa sinensis, will shield the cell system and its constituent parts from cytotoxic harm.

2. Anti-cancer Activity

Oral cancer cell lines KB (ATCC CCL-17) were treated with 75 µg and 125 µg of H. rosa sinensis oil extract for 24 hours. After subjecting the treated cells to DNA fragmentation assay, and using agarose gel electrophoresis, it was observed that the cells' DNA from both concentrations has been fragmented compared to control sample. This means that Hibiscus extract hindered the growth and proliferation of oral cancer cells [43]. It was also shown that 250 µg of 90% methanolic leaves extratc inhibited HT-29 colorectal AGS cell lines by 100%. The cell viability percentage was measured using MTT assay and the calculated IC50 was found to be 90.79 µg/ml. The phytochemical analysis suggested that this significant anticancer activity was mostly due to flavonoids and terpenoids content in the leaves

3. Antidiabetic Effects

Using doses of 100 and 200 mg/kg of body weight, it lowered blood glucose levels from 281.6 ± 3.7 mg/dI to 92.2 ± 2.63 and 83.8 ± 3.15 mg/dI, respectively, as opposed to 103.37 ± 2.13 mg/dI in insulin-injected NOD mice, which served as a positive control [49]. After five weeks of oral dosing, the studied extracts also considerably decreased blood urea, triglycerides, glycosylated hemoglobin, and cholesterol levels [49]. After 15 days of oral dosing, blood glucose levels in alloxan-induced type II rats (150 mg/kg) decreased from 300.23 ± 32.20 to 220.41 ± 20.40 mg/dl in rats treated with glibenclamide (600 µg/kgbw).

4. Antimicrobial Properties

Pseudomonas aeruginosa, Escherichia coli, Enterobacter aerogenes, and Streptococcus pyogenes were found to be susceptible to the antibacterial

effects of methanol extracts made from H. rosa-sinensis leaves. At 80 µg/ml of leaf methanolic extract, the maximum observed zone of inhibition was 13 ± 00 mm against E. coli and 12 ± 00 mm against both S. aureus and E. aerogenes during a 24-hour incubation period at 37° C using the well diffusion method. These microbes were isolated from affected skins, and the study found that flavonoids, tannins, terpenoids, saponins, or alkaloids may be the chemical compounds causing the antibacterial action.

5. Anti-fertility activity

Methanolic extract from the flowers of Hibiscus rosa sinensis has been shown to be effective against the activity of alkaline phosphatase in vitro. At a concentration of 100 mg/mL, quercetin-7-O galactoside, which was separated from its water-soluble component, completely inhibited the enzyme activity. Complete inhibition of this enzyme was linked to inhibition of implantation, a mechanism strongly associated with the contraceptive process. Male albino rats' spermatogenesis was similarly impacted by oral treatment of aqueous floral extract. Histological analysis using H&E stain revealed that extending the duration of treatment with an increased extract dosage resulted in alterations like a broken and discontinuous base membrane, complete disarray of spermatogenic cells, broken Sertoli cells, and the lack of Leydig cells and mature spermatozoa.

6. Anti-fungal Activity

Prior research has demonstrated the antibacterial properties of methanol extracts made from Hibiscus rosa-sinensis leaves against Trichophyton rubrum, Aspergillus niger, Candida albicans, and Candida parapsilosis. Using the well diffusion method, the maximal zone of inhibition was 9.3 ± 0.57 mm against Aspergillus niger and 6.6 ± 0.57 mm against Candida albicans at a concentration of 80 µg/ml of leaf methanolic extract following a 24-hour incubation period at 37° C. These fungi were isolated from affected skins, and the chemical compounds found in the study may be flavonoids, tannins, terpenoids, saponins, or alkaloids that have antifungal properties.

7. Anti-inflammatory activity

Rectal injection of H. rosa sinensis hydroalcoholic leaf extract improved colitis caused by 4% acetic acid in male Wister rats. The colon ulcer area decreased to 20.67 ± 2.40 mm2 after a 7-day treatment with 200 mg/kg, p.o. of extract, compared to 10.00 ± 1.23 mm2 in the prednisolone treatment group, which was used as a positive control, and 41.67 ± 1.96 mm2 in the negative control group. This activity may have been influenced by the phytochemicals that were present, including steroids, polyphenols, alkaloids, and flavonoids.

8. Gastroprotective activity

When albino Wistar rats' stomach tissues were exposed to 600 µg/kg carbachol and pylorus ligation, the aqueous-ethanolic extract of Hibiscus rosa sinensis aerial parts showed protection of the mucosal layer. When compared to the control group, extract administration at a dose of 500 mg/kg produced an 82% protection rate, while treatment with 2.5 mg/kg cimetidine and 10 mg/kg b.w. verapamil produced 88% and 81% protection, respectively.

CONCLUSION:

In China and other tropical nations, Hibiscus rosa sinensis, a member of the Malvaceae family, has long been utilized as a traditional medicinal plant. All of its components have been used as contraceptives and to treat bacterial infections, fever, and inflammation. The primary phytochemicals that are found in various extracts and are most likely in charge of their biological activities are flavonoids, tannins, terpenoids, saponins, and alkaloids. This plant's reduced toxicity may make it suitable for application as a novel medicinal agent.

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Cite: Nitin Mahale, Santosh Ghule, Vaishnavi Chavan*, Suraj Ujgare, Ronit Bhoir, A Review on Hibiscus Rosa-Sinensis: Phytochemistry and Medicinal Uses, Int. J. Med. Pharm. Sci., 2026, 2 (4), 45-50. https://doi.org/10.5281/zenodo.19473462