Systematic Review and Pharmacological Potential of *Hibiscus Rosa-Sinensis* as Antidiabetic Drug

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Abstract: The Hibiscus Rosa-Sinensis is a flower that has been used in traditional Chinese medicine for centuries. Recently, there has been renewed interest in the potential health benefits of this flower, particularly with regards to its Antidiabetic effects. A number of studies have shown that the extract from Hibiscus Rosa-Sinensis can help to lower blood sugar levels in people with diabetes mellitus, and it is thought that this may be due to the presence of certain compounds within the plant that have hypoglycemic activity. The exact mechanisms by which Hibiscus Rosa-Sinensis lowers blood sugar levels are not fully understood at present, but it is thought that it may work by stimulating insulin secretion from the pancreas or by improving glucose tolerance.

Keywords: Hibiscus Rosa-Sinensis, Antidiabetic Drug, Herbal Antidiabetic Drug, Traditional Medicines

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INTRODUCTION

Hibiscus rosa Sinensis is a species of hibiscus native to east Asia. It is known by many names, including China rose, shoe flower, and Hawaiian hibiscus [1]. It is a Malvaceae family member, including okra, cotton, mallows, and hollyhock. Hibiscus Rosa Sinensis is an evergreen shrub or small tree

growing to 5 m tall. The leaves are deeply lobed with five or seven lobes, and the lobes are further subdivided into smaller lobes [2]. The flowers are large, up to 15 cm in diameter, with five petals that may be pink, red, orange, or yellow, with numerous stamens in the center. Hibiscus Rosa Sinensis has been used in traditional medicine for centuries and is still popular today [3]. The flowers are used to make teas and tinctures, which are said to have medicinal properties. The plant is also used in cosmetics and essential oils [4].

This plant belongs to the subkingdom Magnoliophyta, a group of flowering plants that includes the majority of plant species familiar to us, such as roses, apple trees, and tulips. The subkingdom consists of two groups the Magnoliopsida, which are also known as Dicotyledons, and Liliopsida, which are more commonly referred to as monocotyledons. Dicotyledons have two seed leaves or cotyledons, while monocots only have one [5].

This particular plant is a monocot. The vast majority of plant species on Earth are flowering plants belonging to the group Magnoliophyta [6]. This group contains over 400,000 species, including some of the most well-known and widespread plants, such as roses, apple trees, and tulips. The Magnoliophyta can be divided into two main groups: the Magnoliopsida (Dicotyledons) and the Liliopsida (monocotyledons) [7].

Traditionally, Hibiscus flowers have been reported to possess Antidiabetic properties and have been used in treating diabetes. The flower extract contains many flavonoids and other phytoconstituents with known antioxidant, anti-inflammatory, and anti-carcinogenic activities [8]. Hibiscus is also rich in ascorbic acid (vitamin C), enhancing its health-promoting effects. Scientific studies have shown that hibiscus tea can help lower blood pressure by relaxing the smooth muscles on the walls of blood vessels. It can also improve liver function and digestion and promote weight loss [9].

Current scientific literature suggests that more than 50% of today's clinical medications are of natural product origin. This is an incredible statistic, and it highlights the importance of natural products in medicine. For centuries, people have been using plants and other natural substances to treat various ailments, and modern science is finally catching up. With more and more drugs being developed from natural sources, it is clear that these products have a lot to offer in terms of therapeutic potential [10].

This plant is economically very essential owing to its herbal products and medicinal uses. The stem and leaves are used to prepare an herbal tea that is effective in treating cold, cough, sore throat, etc. This plant is also cultivated as an ornamental plant owing to its beautiful white flowers [11].

The oil extracted from the flower is fragrant and is used in many cosmetic products. This plant has a long medicinal use dating back thousands of years. In traditional Chinese medicine, the roots are warming and grounding, while the stems and leaves are cooling and drying [12]. The herb is commonly used to treat colds, coughs, sore throats, and other respiratory infections. It is also said to boost the immune system, improve circulation and digestion, relieve stress, and promote restful sleep [13].

Classification and Botany

Hibiscus rosa-Sinensis is a tropical plant commonly grown as an ornamental plant. It is native to East Asia and has been introduced to many other parts of the world. The plant is a member of the Hibiscus family, which includes over 200 species [14]. Hibiscus rosa-Sinensis is a shrub or small tree that can grow to 6 m (20 ft.). The leaves are alternate, ovate-shaped, and have serrated margins. The flowers are large and showy, with five petals that range in color from white to pink to red. The fruit is a capsule containing numerous seeds [13].

It is classified in the order 'Malvalves' because the petals of the flower overlap, which is a defining characteristic of this order. The hibiscus belongs to the family of 'Malvaceae,' and there are many different species within this family. Hibiscus rosa-Sinensis, or Chinese hibiscus, is one of the most popular species [15]. It is native to East Asia but has been introduced to other parts of the world and can now be found in tropical and subtropical regions worldwide. Hibiscuses are generally shrubs or small trees and have large, showy flowers. They are often used as ornamental plants; some varieties are also used in herbal medicine [16].

Hibiscus rosa-Sinensis grows in small trees or shrubs. The flowers are large, showy, and of many colors, including red, yellow, white, and pink. The flowers have five petals fused at the base and a long stamen that protrudes from the center of the flower [17]. Hibiscus rosa-Sinensis is native to tropical Asia and is widely cultivated in warm climates worldwide. Hibiscus rosa-Sinensis grows best in humid climates with plenty of rainfall.

The tree can grow up to 6 m tall with a spread of 4 m. The leaves are dark green and shiny, with serrated edges. The flowers are borne in clusters at the ends of branches or on new growth. Each flower is about 5-10 cm across and has five fused petals at the base. There is a long stamen that protrudes from the center of each flower. Hibiscus rosa-Sinensis is native to tropical Asia but is now cultivated in a warm environment [18].

Moreover, moving to the external part, the flower has a 2.5 cm long calyx (cup-shaped), green in color with four sepals. The flower also has six petals, which are violet in color and are arranged in two rows of three each. The outermost row of petals is slightly bigger than the inner row [19]. Many stamens (the male reproductive organ) are present inside the flower, which is long and thin and has yellow anthers (the pollen-producing part). The pistil (the female reproductive organ) is located at the center of the flower and has a white stigma (the part where pollination takes place) at its top. Overall, it can be said that the anatomy of this flower is quite complex yet beautiful [20].

Another molecule, known as cyanidin-3-sophoroside, was also extracted from Hibiscus rosa-Sinensis flowers. Cyanidin-3-sophoroside is a type of anthocyanin, a class of water-soluble vacuolar pigments found in plants. These pigments are responsible for giving flowers their red, purple, and blue colors. Cyanidin-3-sophoroside is the pigment that gives Hibiscus rosa-Sinensis flowers their characteristic pink color [21].

Habitat

Hibiscus rosa-Sinensis is a tropical plant that is native to China and India. It can be found in other tropical areas, such as Hawaii and the Caribbean. The plant grows in moist, shady areas. It prefers soil that is high in organic matter [22]. Hibiscus rosa-Sinensis can grow to be 6 feet tall and 10 feet wide. The leaves are dark green and glossy. The flowers are large and showy, with five petals that range in color from white to pink to red. Hibiscus rosa-Sinensis blooms from summer to fall [23].

Soil Type

Hibiscus rosa-Sinensis prefers well-drained soil with a pH between 5.5 and 6.5. It is not particular about soil type but does best in rich or sandy loam. Hibiscus rosa-Sinensis can tolerate some drought but does best with consistent moisture [24].

Water

Hibiscus rosa-Sinensis water requirement is medium. It needs at least 1 inch of water per

week during the growing season. The plant can tolerate occasional droughts but will not flower as prolifically. Hibiscus rosa-Sinensis is a heavy feeder and benefits from being fertilized every 2-4 weeks during the growing season. A balanced fertilizer should be used at half-strength [25].

Taxonomical Classification

Hibiscus rosa-Sinensis classification is controversial. Some botanists believe it should be classified under the separate genus, Hibiscus, while others believe it should remain under the genus Rosa. The debate is mainly because Hibiscus rosa-Sinensis exhibits characteristics of both genera [26].

Taxonomic Hierarchy

Kingdom	Plantae – plantes, Planta, Vegetal, plants
Subkingdom	Viridiplantae – green plants
Infrakingdom	Streptophyta – land plants
Superdivision	Embryophyta
Division	Tracheophyta – vascular plants, tracheophytes
Subdivision	Spermatophytina – spermatophytes, seed plants, phanérogames
Class	Magnoliopsida
Superorder	Rosanae
Order	Malvales
Family	Malvaceae – mallows, mauves
Genus	Hibiscus L. – rosemallow, rose-mallow
Species	Hibiscus rosa-sinensis L. – Chinese hibiscus, shoe-black plant

Leaves

The Hibiscus rosa-Sinensis leaves have a midrib, which is the primary structural support for the leaf [27]. The midrib extends from the base of the leaf to the tip, and branches off into smaller veins that help to support the rest of the leaf. The hibiscus rosa-Sinensis leaves also have a network of tiny pores on their surface, which helps to exchange gases and water vapor with the atmosphere [28].

Flower

Hibiscus rosa-Sinensis flower anatomy includes a five-parted calyx, numerous Stamens with purple anthers, and one Pistil with a white stigma. The flowers have both male and female reproductive organs (perfect flowers). The Hibiscus rosa-Sinensis flower is pollinated by insects such as bees and butterflies [29]. After pollination, the flowers turn into fleshy fruits called "Hibiscus berries" or "Jamaica sorrel." The Hibiscus rosa-Sinensis is native to tropical Asia and parts of Malaysia. However, it has been introduced to other tropical regions, including Hawaii, Africa, and the Caribbean. The plant grows best in sandy soils with plenty of organic matter and total sun exposure. It can reach a height of 10 feet (3 m) tall with proper care [30].

Stem

Hibiscus rosa-Sinensis stem anatomy consists of an outer cortex composed of thin-walled parenchyma cells and a central stele made up of xylem and phloem tissue. The hibiscus stem has a hollow growth form known as a pseudo stem; the leaves grow directly from the plant's central axis [31]. Each leaf is attached to the stem via a petiole, and leaflets are arranged in pairs along the length of the petiole. The hibiscus flower consists of five sepals and five petals. The sepal structure protects the flower during bud development, while the petals attract pollinators such as bees and butterflies [32].

Root

Hibiscus rosa-Sinensis root anatomy consists of an outer cortex, inner stele, and vascular cambium. The cortex is the thickest layer of the root and comprises parenchyma cells. The stele is the central core of the root and consists of xylem tissue in its center and phloem tissue surrounding it. The vascular cambium is a thin layer of actively dividing cells that produce new xylem tissue on the inside and new phloem tissue on the outside [33].

PHYTOCHEMICALS AND PHARMACOLOGICAL PROPERTIES

The flower petals and leaves of Hibiscus rosa-Sinensis L. have been shown to contain anthocyanins, carotenoids, flavonoids, and tannins [34]. These phytochemicals give the plant its characteristic red color and are also responsible for its medicinal properties. Anthocyanins are thought to be responsible for the Hibiscus rosa-Sinensis L.'s anti-inflammatory activity, while the flavonoids may contribute to the plant's antioxidant and anticancer activities [35].

Flavonoids

Hibiscus rosa-Sinensis flavonoids have potential therapeutic effects in treating

Alzheimer's disease. Hibiscus rosa-Sinensis is a plant used in traditional Chinese medicine for centuries. The plant contains several flavonoids, including quercetin, rutin, and Kaempferol [36]. These flavonoids have been shown to have antioxidant, anti-inflammatory, and neuroprotective properties. In animal studies, hibiscus rosa-Sinensis flavonoids have improved memory and cognitive function.

Additionally, these flavonoids may help to protect neurons from damage caused by beta-amyloid plaques. Beta-amyloid plaques are a hallmark of Alzheimer's disease. More research is needed to confirm the therapeutic effects of hibiscus rosa-Sinensis flavonoids in humans [37].

Tannins

Hibiscus rosa-Sinensis tannins have shown anti-ulcerogenic potential in rats and humans. Tannins are known to have astringent, antimicrobial, and antioxidant properties. The leaves of hibiscus rosa-Sinensis contain more tannins than the flowers [38]. In a study, an extract of hibiscus leaves inhibited gastric acid secretion and ulcer formation in rats. Another study showed that aqueous extracts of hibiscus rosa-Sinensis flowers could accelerate the healing of gastric ulcers in rats. These studies suggest that hibiscus tannins may be beneficial in the treatment of stomach disorders such as peptic ulcer disease [39].

Carotenoids

Hibiscus rosa-Sinensis carotenoids can be found in hibiscus plants' flowers, leaves, and stems. These carotenoids are responsible for hibiscus flowers' red, orange, or yellow coloration. The most common carotenoids in hibiscus plants are lutein, beta-carotene, and lycopene. Hibiscus rosa-Sinensis carotenoids have been shown to have antioxidant, anti-inflammatory, and anticancer properties [40].

Anthocyanins

Hibiscus rosa-Sinensis Anthocyanins may improve microcirculation and prevent cardiovascular diseases. Hibiscus rosa-Sinensis is a plant native to China [40]. The flowers are used to make tea, which has been shown to lower blood pressure. Hibiscus tea is rich in Anthocyanins; antioxidants that can help improve microcirculation and prevent cardiovascular diseases [41].

Diabetes

Diabetes is a chronic disease affecting how the body processes blood sugar. This causes high blood sugar levels, which can lead to serious health problems, such as heart disease, stroke, kidney disease, nerve

damage, and blindness. There are two main types of diabetes: type 1 and type 2 [42].

Type 1 diabetes is usually diagnosed in children or young adults. It occurs when the pancreas produces little or no insulin. People with type 1 diabetes must take daily insulin injections to survive. Type 2 diabetes is far more common than type 1 diabetes. It typically develops in adulthood but is now being diagnosed more frequently in children and adolescents due to the rise in obesity rates. In type 2 diabetes, either the pancreas does not make enough insulin, or the cells do not use it properly (a condition called "insulin resistance") [43].

Types of Diabetes

Type 1 Diabetes

Type 1 Diabetes is a lifelong condition that is currently incurable. It occurs when the body is unable to produce enough of the hormone insulin or when it is unable to use insulin effectively. Insulin is responsible for regulating blood sugar levels, so without it, blood sugar levels can become dangerously high [44]. Type 1 diabetes most often starts in childhood or adolescence, but it can also occur in adults. Symptoms include increased thirst and urination, extreme hunger, weight loss, fatigue, and blurred vision. If untreated, type 1 diabetes can lead to severe complications such as ketoacidosis (a build-up of acids in the blood), which can be fatal. Treatment involves taking insulin injections daily and making lifestyle changes such as following a healthy diet and exercising regularly [45].

Type 2 Diabetes

Type 2 Diabetes is a severe medical condition that can lead to several health complications, including heart disease, stroke, kidney failure, and blindness. If diabetes persists, it is essential to see the doctor regularly and carefully monitor blood sugar levels. There are several treatments available for diabetes, and with proper treatment and care, most people with diabetes can live long and healthy lives [45, 46].

Current Treatment

Current treatment of Diabetes involves insulin therapy and management of blood sugar levels. There are different types of insulin available, and the type prescribed depends on several factors, including the severity of Diabetes, timing and amount of meals, activity level, and other medications. Insulin therapy requires regular monitoring by a healthcare professional to ensure that blood sugar levels are within the safe range to avoid complications such as diabetic ketoacidosis [47].

There are several different treatments currently available for Diabetes. These include insulin therapy, lifestyle changes, and medication. Insulin therapy is the most common treatment for Diabetes. This involves injecting insulin into the body regularly to regulate blood sugar levels. Lifestyle changes such as diet and exercise can also help to control blood sugar levels. Medication can also be used to treat Diabetes, although this is not always effective [48].

Current medications for type 2 diabetes are diet and exercise, metformin, pioglitazone/glimepiride, sitagliptin/metformin, exenatide, liraglutide, and albiglutide [49]. The goal of treatment for type 2 diabetes is to achieve and maintain near-normal blood glucose levels without producing hypoglycemia. Various medications help people with type 2 diabetes control their blood sugar levels. These include oral medicines such as metformin, pioglitazone/glimepiride, sitagliptin/metformin, exenatide, liraglutide, and albiglutide; insulin injections; and lifestyle changes including diet modification and exercise [50].

Diabetes and Herbal Drugs

Many different herbal drugs have been traditionally used to treat diabetes. These include ginseng, bilberry, fenugreek, and chromium. While some scientific evidence supports the use of these herbs in diabetes treatment, more research is needed. Herbal drugs can interact with other medications, so it is essential to talk to the doctor before starting any new treatments [51].

These include ginseng, bilberry, fenugreek, and chromium. While some scientific evidence supports the use of these herbs in diabetes treatment, more research is needed. Herbal drugs can interact with other medications, so it is essential to talk to the doctor before starting any new treatments [52]. Traditional Drugs in diabetes care are very effective in managing blood sugar levels. These drugs help in reducing insulin resistance and also help in improving the sensitivity of cells toward insulin. However, these drugs come with a long list of side effects, which can be dangerous for the patients [53].

There are many herbal mechanisms for diabetes treatment that many people are not aware of. This method involves the use of specific herbs that are effective in regulating blood sugar levels. Gymnema Sylvestre is

one of the most popular herbs in this type of treatment. Gymnema Sylvestre is a plant used in Indian traditional medicine for centuries [54].

It is known to help regulate blood sugar levels by stimulating insulin production and helping control cravings for sweets. Another herb that has shown promise in controlling blood sugar levels is fenugreek. Fenugreek seeds contain a compound called Foeniculum, which has been shown to lower blood sugar levels by stimulating the release of insulin from the pancreas [55].

Traditional Drugs in Diabetes

There are a variety of traditional drugs used to treat diabetes, and they can be broadly classified into two groups: those that help control blood sugar levels and those that help manage the complications of diabetes [56]. Blood sugar-lowering drugs include insulin, sulfonylureas, meglitinides, iguanids, and thiazolidinedione. These drugs work in different ways, but all help lower blood sugar levels by stimulating the pancreas to produce more insulin or increasing cells' sensitivity to insulin. Drugs used to treat diabetes complications include ACE inhibitors (angiotensin-converting enzyme inhibitors), angiotensin receptor blockers (ARBs), calcium channel blockers, beta-blockers, and statins [57]. These drugs can help prevent or delay the onset of some of the severe complications of diabetes, such as heart disease, stroke, kidney disease, and nerve damage [58].

Antidiabetic Potential of Hibiscus rosa-sinensis

Banerjee, M., et al., (2020) explained the Hibiscus rosa-Sinensis Linn is a medicinal plant that has been used in traditional medicine for the treatment of diabetes. The leaves and flowers of Hibiscus rosa-Sinensis Linn are rich in compounds like Anthocyanins, flavonoids, and phenolic acids, which have been shown to have Antidiabetic properties. Several studies have been conducted to evaluate the hypoglycemic effect of Hibiscus rosa-Sinensis Linn in animal models of diabetes. The results of these studies suggest that Hibiscus rosa-Sinensis Linn can lower blood sugar levels by stimulating insulin secretion from the pancreas and increasing glucose uptake by cells. Hibiscus rosa-Sinensis Linn may also help prevent complications associated with diabetes, such as diabetic nephropathy and neuropathy [59].

Pillai, S. S., et al., (2018) studied Antidiabetic potential of Hibiscus rosa-Sinensis. It is commonly known as rose mallow, Chinese hibiscus, or shoeblack

plant—the Hibiscus rosa-Sinensis Linn. The flower has been used in traditional medicine to treat diabetes and its complications. Various studies have shown that Hibiscus rosa-Sinensis flower extract has Antidiabetic potential in experimental animal models of diabetes mellitus by modulating carbohydrate metabolism, improving insulin sensitivity, and reducing oxidative stress. This review summarizes the current evidence on the Antidiabetic potential of Hibiscus rosa-Sinensis flowers and their possible mechanisms of action [60].

Ndarubu, T. A., et al., (2019) the present study evaluated the Antidiabetic potential of Hibiscus rosa-Sinensis Linn. (Family: Malvaceae) flower extract in alloxan-induced diabetic rats. The diabetes was induced by a single intraperitoneally injection of alloxan monohydrate (120 mg/kg body weight). The hibiscus flower extract was administered orally at a dose of 200 and 400 mg/kg body weight for 30 days. The study showed that treatment with hibiscus flower extract significantly decreased the blood glucose levels in alloxan-induced diabetic rats compared to untreated diabetic rats. Treatment with hibiscus flower extract also improved the lipid profile by reducing total cholesterol, triglycerides, and low-density lipoprotein levels and increasing high-density lipoprotein levels in alloxan-induced diabetic rats. These results suggest that hibiscus flower extract could have the potential of Antidiabetic [61].

Pillai, S. S., & Mini, S. (2018), Hibiscus rosa-Sinensis Linn is a plant traditionally used to treat diabetes in Asia. Several studies have investigated the Antidiabetic potential of Hibiscus rosa-Sinensis Linn and its effect on various parameters related to diabetes. The results of these studies suggest that Hibiscus rosa-Sinensis Linn can effectively reduce blood sugar levels, improve insulin sensitivity, and reduce lipid levels in people with diabetes. Overall, the evidence suggests that Hibiscus rosa-Sinensis Linn is potentially an Antidiabetic agent and could benefit people with diabetes [62].

Oladoja, F., et al., (2021) Hibiscus rosa-Sinensis is a popular medicinal plant used in various traditional systems of medicine to treat diabetes. The present study was undertaken to evaluate the Antidiabetic potential of HR in alloxan-induced diabetic rabbits. Oral administration of HR extract (250 and 500 mg/kg body weight) significantly improved the blood glucose level, glycosylated hemoglobin, and fasting insulin levels in alloxan-induced diabetic rabbits. Furthermore, HR extract treatment

significantly increased the activities of hexokinase, glucokinase, fructose-1,6-bisphosphatase, and glucose-6-phosphatase in the liver and muscles of alloxan-induced diabetic rabbits. The results of the present study suggest that HR has significant Antidiabetic potential and can be used as an effective natural remedy for treating diabetes [63].

Ansari, P., et al., (2020) the study was undertaken to evaluate the Antidiabetic potential of Hibiscus rosa-Sinensis Linn (Family: Malvaceae) in streptozotocin (STZ)-induced diabetic rats. The STZ-induced diabetic rats were treated with aqueous extract of Hibiscus rosa-Sinensis Linn at a dose of 200 mg/kg body weight/day for 30 days. There was a significant decrease in fasting blood sugar levels, glycosylated hemoglobin, and insulin levels in the Hibiscus rosa-Sinensis Linn treated group compared to the STZ-induced diabetic control group. There was also a significant increase in the levels of serum HDL cholesterol and hepatic glycogen content in the Hibiscus rosa-Sinensis Linn treated group as compared to the STZ-induced diabetic control group and found that Hibiscus rosa-Sinensis could reduce the diabetes [64].

CONCLUSION

The study concludes that the Hibiscus rosa-Sinensis flower has Antidiabetic potential. The extracts of the flower significantly decreased the blood sugar levels in rats. Flowers are a rich source of flavonoids and other bioactive compounds, which might be responsible for their hypoglycemic effect. Further studies are needed to elucidate the mechanism of action and to confirm its Antidiabetic potential in humans.

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