

Review Article

Hibiscus mutabilis: Exploring the Phytochemical Diversity and Therapeutic Potential of a Traditional Medicinal Plant

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Abstract

Hibiscus mutabilis, commonly known as cotton rose mallow, is a medicinal plant belonging to the family *Malvaceae* and is widely recognized for its ornamental as well as therapeutic value. The plant has been traditionally used in various systems of medicine to manage several health conditions, including inflammation, infections, hypertension, gastrointestinal disorders, and skin diseases. Different parts of the plant such as flowers, leaves, roots, and bark have been employed in ethnomedicine due to their potential healing properties. The pharmacological activities of *Hibiscus mutabilis* are largely attributed to its rich phytochemical composition, which includes flavonoids, phenolic compounds, anthocyanins, terpenoids, and other bioactive constituents.

Recent scientific studies have demonstrated that extracts of *Hibiscus mutabilis* exhibit a variety of biological activities such as antioxidant, anti-inflammatory, antimicrobial, hepatoprotective, antidiabetic, and anticancer effects. These pharmacological properties provide scientific support for its traditional medicinal applications and highlight its potential as a promising source of natural therapeutic agents. This review aims to summarize the available literature on the phytochemical constituents, pharmacological activities, and ethnomedicinal significance of *Hibiscus mutabilis*, emphasizing its potential for future research and drug development.

Keywords: *Hibiscus mutabilis*, Cotton rose mallow, Phytochemicals, Pharmacological activities, Ethnomedicinal uses, Medicinal plants.

Introduction

Hibiscus mutabilis also known as Confederate Rose belongs to *Malvaceae* family of perennial flowering plants. Native to the tropical and sub-tropical regions of the world, it is grown for its very attractive large

flowering decorations, which begin in a white state and then change to pink as they age. In addition to being an attractive flowering plant it has tremendous cultural importance in various communities, being used in ethnomedicine as well as being an essential part of the

traditional folk practices prevalent in the societies. Being an indispensable plant species not only as a highly cultivated attractive ornamental plant species but also as a medicinal plant and hence its validation, as to its existence in nature, demands an extensive scientific investigation [1].

In traditional medicine, the flowers and leaves of this species are used in different cultures in Africa and Asia to treat several types of health conditions such as; hypertension, inflammation and a variety of gastrointestinal disorders. Ethnomedical use of plants is a very complex system that integrates many aspects of the cultural life of a community by using plants as part of their life style [2]. In the Chinese traditional medicine, the *Hibiscus sabdariffa mutabilis* also has cooling properties used to treat conditions of excess heat in the body and it is used to quell fevers and can be used as a diuretic to remove toxins from the body. Also, its flowers are used for preparing a drink which acts as a diuretic and detoxifier. This makes the ethnomedical use of this plant to be an efficient way to introduce the phytochemicals and pharmacological effects of the plant [3].

The intercultural relevance of *H. mutabilis* for us underscores the complex relationship between indigenous knowledge and scientific evidence. In the light of ethno-botanical uses, we generate hypotheses about plant biochemistry and our experiments based on universally accepted scientific procedures help to corroborate these uses and to validate the information at

a more quantitative level. The considerable ethno-medical value of the species in both the systems suggests enormous scope of this valuable plant at the level of complementary and alternative medicine as well as in the context of phytopharmacology where the drug development processes are carried out by taking into consideration the traditional drug taking habits of local people [4].

The uses of *Hibiscus mutabilis* in different culture represents a vast scope of pharmacological investigations. Therefore, the plant acts as a link between traditional and alternative medicine and modern drug development. Combining ethnobotanical survey along with pharmacological studies will further extend the use of this medicinal plant species. This plant is sure to open up more avenues in medicinal sector and may lead to the discovery of novel drugs from traditional medicines. *H. mutabilis* thus helps in connecting traditional medicine and modern drug development. Different scientific studies have shown the presence of diverse classes of bioactive compounds namely flavonoids, anthocyanins and phenolic acids [1].

It is commonly known by its unusual characteristic of colour change in the flowers from buds to fully mature flower. The petals change through shades of pink and red to almost purple. The plant is thus an important source of colours for floral industries. The phytochemical studies carried out on *H. mutabilis* revealed the presence of delphinidin and cyanidin

derived anthocyanins in its petals. Recent researches clearly showed that in addition to providing colours to the flowers these pigment derivatives also have anti-inflammatory activities that can also be beneficial for curing chronic inflammatory diseases. Further the neuroprotective and cardioprotective activities associated with anthocyanins present great opportunities of scientific investigations in the areas of drug development [5].

Various secondary metabolites such as phenolic acids have also been reported from roots of *Hibiscus mutabilis*. A comprehensive study revealed the presence of various significant bioactive metabolites such as chlorogenic acid, caffeic acid along with other derivatives. Being notable antioxidants, these are reported to be endowed with significant anti-inflammatory activity. Phenolic acids are reported to contribute towards multifaceted health benefits including the management of metabolic disorders along with improving the vascular health. In addition, these phenolic acids are reported to bind to numerous biological targets, hence contributing towards the attenuation of cardiovascular diseases as well as metabolic syndrome [3].

Phytochemical investigations of the plant, *Hibiscus mutabilis*, that contains phytoconstituents already worked out also indicated the presence of certain number of unexplored bioactive phyto-molecules. Hence, studying the mutual interactions of various known constituents in the plant extract will not only highlight their possible synergistic contributions

towards their medicinal values but it will also pave ways towards discovery of futuristic pharmaceuticals.

The recent advancements in extraction and chromatographic techniques have led to a more comprehensive investigation of phytoconstituents of *Hibiscus mutabilis*. The ongoing in vivo and in vitro evaluations of extracts of the plant may lead to the discovery of new drugs. The phytochemical analysis of the plant suggests the presence of various classes of polyphenols, flavonoids, organic acids and anthocyanins. The antioxidant and anti-inflammatory properties of the plant are attributed to these phytoconstituents [6].

The main bioactive compounds identified in the aerial parts of *Hibiscus mutabilis* are quercetin, kaempferol and various significant anthocyanins pigments, delphinidin and cyanidin derivatives [7]. The bioactive compounds present in this plant are responsible for its various attributes such as color, taste and medicinal properties. Flavonoids derived from *H. mutabilis* like quercetin have been reported to possess potent antioxidant activity, wherein they scavenged different free radicals, and inhibited various enzymatic activities of antioxidants in the organism thus providing protection against oxidative stress associated diseases [8].

Besides the pharmacological effects, the biological potential of *Hibiscus mutabilis* concerning its antimicrobial, anti-inflammatory and hepatoprotective potential has been reported [1]. Thus, different plant extracts were assayed for antibacterial activity in-vitro.

The results showed the inhibition of various bacterial strains by the petals and leaves extracts such as *Escherichia coli* and *Staphylococcus aureus* [9]. Moreover, *H. mutabilis* flower extract exhibited an effective anti-inflammatory activity via modulation of pro-inflammatory cytokines and enzymes thus corroborating its folkloric usage in treating inflammatory diseases including Arthritis and skin infections [10].

In addition, research on the hepatoprotective activity of *Hibiscus mutabilis* was also conducted. Pre-treatment with aqueous extracts of *Hibiscus mutabilis* foliage prior to administration of paracetamol led to a marked decrease in liver damage in treated animals, when compared to controls. The extracts are postulated to confer protection by inhibiting lipid peroxidation and by stimulating liver function as indicated by enhanced hepatic SOD, catalase and GSH levels and by increased activity of liver enzymes. Hepatoprotective activity is highly relevant especially in the context of increasing prevalence of chronic liver diseases in humans worldwide and hence further studies into the drug development of this plant is merited [11].

Ethnomedical importance of *Hibiscus mutabilis* is largely linked to the traditional herbal medicines prevalent in many cultures and civilizations for hundreds of years. Commonly, in countries like East Asia and other parts of Africa, the flowers of this plant are commonly used as a medicinal drink to lower blood pressure and treat various abdominal disorders [12]. The long-standing use of this plant in various traditional

medicinal systems is highly relevant and essential to carry out more scientific investigations, proving the pharmacological benefits and thus further studies are required in humans to validate existing ethnomedical claims.

In addition to its immense aesthetic value, *Hibiscus mutabilis* holds high potential for the discovery of new drugs. In an era where phytotherapy is being increasingly practiced and with the preponderance of the use of natural products in health care, *H. mutabilis* merits more serious investigation as a possible alternative or complementary source of useful drugs for the treatment of certain diseases. By merging phytochemical investigations with ethnobotanical data and pharmacological evaluations, one could perhaps bring to the surface the hidden potential of this plant, and open the way to the development of new drugs and so contribute to the emergence of a more sustainable drug development Programme that will enable man to efficiently and rationally utilize the natural resources available to him for the improvement of his health [13]. Considering the large number of phytochemicals in this plant along with the promising pharmacological values and long standing ethnomedical uses, *Hibiscus mutabilis* appears to be a fascinating candidate for development of new drugs [14].

The antioxidant activity of *Hibiscus mutabilis* has been confirmed in a number of scientific studies, where it has demonstrated its capacity to neutralize ROS and reduce oxidative stress. The bioactive compounds responsible for this activity, in general, are constituted by phenolic

acids, flavonoids and anthocyanins, and they are present in several plant parts, such as flowers and leaves [6]. Other studies confirm that the extracts of *Hibiscus mutabilis* possess a considerable free radical-scavenging activity, which may play a significant role in the protection of cells from oxidative damage associated with a number of human diseases including cancer and cardiovascular diseases. Hence, the ability of *Hibiscus mutabilis* to modulate the antioxidant system of the body points towards its possible usage in oxidative stress-related diseases [15].

Anti-inflammatory, *Hibiscus mutabilis* decreases the production of pro-inflammatory cytokines and enzymes. Results have showed a reduction in levels of inflammatory markers in different biological models. Such an effect is due to a reduction in the production of nitric oxide and the inhibition of the transcription factor nuclear factor kappa B (NF- κ B), key regulator of the inflammatory response [16]. The exact composition of bioactive molecules of such plant activity is still to be identified but it has been suggested involvement of quercetin and flavonoids thus providing *Hibiscus mutabilis* with a promising resource for the development of a safer alternative to modern anti-inflammatory drugs [17].

In recent years, the anticancer potential of *Hibiscus mutabilis* has also been examined in detail [18]. A number of studies have demonstrated that various extracts of this plant show cytotoxic activity towards several types of cancer cells such as breast, liver and colon cancer cells [19]. In one study, the induction of

apoptosis in cancer cells by treatment with *H. mutabilis* extract was confirmed by the activation of pro-apoptotic proteins and inhibition of anti-apoptotic proteins. Another study revealed that the plant extract was capable of inhibiting colony formation and metastasis in cancer cells thereby indicating its potential role in cancer prevention and treatment by exerting cytotoxic activity on cancer cells and regulating the key signaling pathways associated with cancer cell growth and proliferation [20].

The pharmacological potentials of *Hibiscus mutabilis* have been validated by the plethora of scientific studies confirming its antioxidant, anti-inflammatory and anticancer activities, thereby confirming its potential as a lead plant for the development of new drugs for modern medicine. Hence, the need for the elucidation of its bioactive compounds and assessment of its clinical efficacy [21].

Conclusion

In addition to the aesthetic value, several plant properties are attributed to the Hibiscus species, in general, and indicate their great importance and merits to soil and ecological sustainable agriculture and ecology and, besides, to biopharmaceutical and ecology development and environment conservation. So, further investigation for ecological study on *Hibiscus mutabilis* and its near relative's species would promote to recognize and use their contributions towards the sustainable ecology and agriculture as effective bioresource to human and environmental development. Presently, several new pharmacological values of

Hibiscus mutabilis were found based on the exploration of bioactivities in relation to various phytochemical constituents, the plant, which possesses unique chemical structure in its compounds and diverse biological activities, was rich in diverse types of phytochemicals including flavonoids, anthocyanins, phenolic acid, and vitamins that contribute to their diverse activities and the confirmation of the presence of quercetin and delphinidin by using various analytical instruments has confirmed its properties of antioxidative and anti-inflammatory reported by other investigators. These plant bioactive molecules which were linked by various studies as contributing to antioxidant property against chronic diseases; act through many pathways enhancing host cell and systemic defense. So, they offer good number of clinical treatments as anti-oxidative properties which helped them to counter act oxidative stress in the biological system, by upgrading the cellular defensive mechanism against different damage through numerous biochemical activities

Conflict of Interest

The Authors declares no conflict of interest.

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