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**AN UPDATED REVIEW ON VARIOUS POTENTIAL PHARMACOLOGICAL
ACTIVITIES OF *HIBISCUS ROSA-SINENSIS* L.**

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ABSTRACT

Phytomedicines are used widely nowadays because of its lesser harmful and better therapeutic effects from natural sources compared to the chemically synthesized ones. The aim of this review is to discuss various pharmacological activities and the chemical composition of *Hibiscus rosa-sinensis* Linn. Several research articles proved that *Hibiscus rosa-sinensis* Linn. plant possesses anthelmintic, anti-oxidant, anti-fertility, anti-depressant, cytotoxic, anti-pyretic, antihypolipidemic and many more effects, which helps to treat or/ and cure many diseases. Therefore, this gives an idea about the medicinal values of the *Hibiscus rosa-sinensis* Linn. plant.

Keywords: *Hibiscus rosa-sinensis*, pharmacological activity, physicochemical parameters, chemical constituents

INTRODUCTION

WHO report [1] is an indicative to an increase in the use of traditional medicines or phytomedicines or herbal medicines globally. Phytomedicines are used in various ways interchangeably with herbal medicines or botanicals. Herbal medicines involve the use of plant parts such as,

seeds, roots, fruits, bark, leaves or flowers for therapeutic purposes [2]. There are so many reports on the use of herbal medicines for the treatment of a wide number of diseases or health conditions. This current review is to discuss the phytochemicals, pharmacological activity of *Hibiscus rosa-sinensis*.

PLANT PROFILE

Synonyms [3]: *Hibiscus arnottii* Griff, ex Mast; *Hibiscus boryanus* DC; *Hibiscus*

cooperi auct; *Hibiscus festalis* Salisb; *Hibiscus liliiflous* Griff, ex Mast; *Hibiscus rosiflorus* Stokes and *Hibiscus storckii* Seem.

Taxonomical Classification [4]:

Kingdom: Plantae

Subkingdom: Tracheobionta

Superdivision: Spermatophyta

Division: Magnoliophyta

Class: Magnoliopsida

Subclass: Dilleniidae

Order: Malvales

Family: Malvaceae

Subfamily: Malvoideae

Genus: Hibiscus

Species: rosa–sinensis

Common Names [5]:

English: China rose, Chinese hibiscus, Shoe-flower, Hawaiian hibiscus, Rose of China.

Bengali: Joba, Jiwa, Oru.

Hindi: Japaapushp, Arahul, Gurhal, Odhul, Java, Jasum, Jasut.

Sanskrit: Japa, Rudrapuspa, Trisandhya, Aundrapuspa.

Oriya: Mondara

Arabic: Bent EL-Kunsil, Khatmah siniyah, Pooq Seni, Hab misk Seni

Chinese: Zhu jin, Da hong hua, Fo sang, Fu sang.

Gujarati: Jasvua, Jasunt.

Marathi: Jasavanda, Jassvandi.

Malayalam: Himbarathi, Ayamparatti, Chebatrathi

Tamil: Sapattuu, Semparutti.

Telugu: Dasanamu, Dasana, Mandarapuvvu.

French: Hibiscus de Chine

German: Chinesischer Roseneibisch

Italian: Rose della Cina

Japanese: Aka-bana, Fusou, Haibisukasu

Portuguese: Rosa-da-China

Spanish: Clavel japonés

Swedish: Hibiscus

Distribution: Hibiscus is widely cultivated in tropical and sub-tropical regions, but its probable origin is tropical Asia. It's cultivated in India, China, Japan and the Pacific islands. This plant is believed to have an Asian origin, hence the name *rosa sinensis* meaning 'rose of China'. It's widely distributed in the following countries: India (south-western regions), Sri-Lanka (tropical regions), Thailand, South Africa, Philippines, Myanmar, China and Pakistan [6].

Traditional use: For medicinal use, the red flowered variety was mainly used. Leaves and roots were believed to have anodyne and emmenagogic properties. Leaves were also used to produce miscarriage (abortifacient) and to stimulate expelling of placenta post childbirth. Flowers were used for the menstrual cycle regulation, for hepatic disorders, hypertension, for eye problems and also as an aphrodisiac. Decoction of leaves, roots and fruits were helpful in the treatment of arthritis, boils

and coughs. Fruits were used externally for sprains, wounds and ulcers [7-10].

The leaves were utilised for dysentery, diarrhoea, as analgesic in traditional medicine of Cook Islands, Haiti, Japan and Mexico [11]. Hibiscus flowers were used in diabetes, epilepsy, bronchial catarrh and leprosy [12, 13]. The flowers have beneficial effects in heart diseases and petals were used as hair-tonic [14, 15]. The roots can be used as cough suppressant. The decoction of root can be used to treat venereal diseases [16-18].

PHYSICO-CHEMICAL PROPERTIES

Root extract [19]: Swelling index-2.5%, Loss on drying-0.53%, Total ash value-7.75%, Acid insoluble ash value- 0.75%, Water soluble ash value-6.32%, Chloroform soluble extractive value-2.80%, Ethanol soluble extractive value-2.60%, Petroleum ether soluble extractive value-1.45%, Carbinol soluble extractive value-15.60%, Water soluble extractive value-5.30%.

Chemical constituents: The preliminary phytochemical analysis showed that *Hibiscus rosa-sinensis* contains tannins, anthraquinones, quinines, phenols, flavonoids, alkaloids, terpenoids, saponins, cardiac glycosides, proteins, free amino acids, carbohydrates, mucilages, essential oils, steroids etc. [20-23]. Flavones from flowers are quercetin-3,5-diglucoside, quercetin-3,7-diglucoside. Flowers contains vitamins such as thiamine (0.031mg%), riboflavin (0.048 mg %), niacin (0.61 mg

%), and ascorbic acid (4.16 mg%), apigenidin, citric acid, fructose, glucose, oxalic acid, pelargonidin [24]. The GC-MS analysis of ethanolic extract of *Hibiscus rosa-sinensis* showed the presence of the major phytochemicals, these are hexadecanoic acid, hexanedioic acid and squalene [25]. Methanolic and ethanolic extract showed phenolics 61.45 ± 3.23 and 59.31 ± 4.31 mg/100g as gallic acid equivalent, total flavonoids 53.28 ± 1.93 and 32.25 ± 1.21 mg/100g as catechine equivalent [26]. The metals in the decoction of leaves were analysed by spectrophotometer, they included: Sodium 129.6-344.2, Potassium 612.9-787.2, Calcium 748.3-907.5, Magnesium 574.8-877.9, Iron 1.16-2.53, Manganese 0.147-0.188, Cobalt 1.25-1.68, Nickel 0.244-0.496, Chromium 0.142-0.164, Copper 0.107-0.129, Cadmium 0.058-0.064, Lead 0.087-0.122, Barium 1.67-2.45 and Aluminium 0.299-0.472 mg/100g [27]. 8-Nonynoic and 9-Decynoic acids and their methyl esters were isolated from the stem bark [28]. Fresh flowers of *Hibiscus rosa-sinensis* gave essential oils, such as, 1-iodoundecane, neopentane,2,2,4-trimethyl-3-pentanone etc. [29].

PHARMACOLOGICAL EFFECTS

Anthelmintic activity: In-vitro anthelmintic activity was evaluated on adult Indian earth worms (*Pheretima posthuma*). These worms were divided in

three groups of six worms in each group to evaluate anthelmintic activity of ethanolic and aqueous extract of *Hibiscus rosa-sinensis* Linn. leaves. The anthelmintic activity was determined in six observations. The time taken for complete paralysis and death were recorded. The extract showed anthelmintic activity at minimal dose of 20mg/ml of ethanol and aqueous extract compared to standard drug like Albendazole. While increasing the concentration (20mg/ml) there was reduction in the paralysis time and death time as well [30].

Antioxidant activity: Results obtained from antioxidant compounds assays are expressed on a dry weight basis. Both ethanolic and aqueous extracts of *Hibiscus rosa-sinensis* flower exhibited rich scavenging effects on DPPH. FRAP assay like the DPPH assay, is considered to be rapid and sensitive, is more of a semi-quantitative assay. In FRAP assay, antioxidant capacity is evaluated based on the capability of the sample extracts to reduce ferric tripyridyltriazine {Fe (III) - TPTZ} complexes to ferrous tripyridyltriazine {Fe (II) -TPTZ}. The higher FRAP value, the greater will be the antioxidant activity of the sample. Results obtained revealed hibiscus to exhibit higher reducing power in aqueous extract compared to ethanolic extract [31]. The antioxidant potential of *Hibiscus rosa-*

sinensis was assessed by TLC bioautography method. The Result revealed that yellowish bands which appeared on the green background were represented as antioxidant [32]; various antioxidant assays for isolated compounds were done by using standard protocols [33-37]. Superoxide scavenging activity of isolated compounds was performed using ascorbic acid as standard. The secondary metabolite possessed wide spectrum of biological activities and also protects the cells from colossal oxidative damage [38]. The scavenging activity of the compounds against nitric oxide was determined by its ability to inhibit the formation of nitrite through direct competition with oxygen and oxides of nitrogen in the reaction mixtures [39]. ABTS assay revealed the inhibitory effects of isolated compounds and ascorbic acid. The isolated glycosides can effectively generate hydrogen radicals due to the presence of free hydroxyl groups and it has the ability to quench free radicals [40]. Results showed that *Hibiscus rosa-sinensis* extract inhibited gradually, in a concentration dependent manner, the superoxide radicals in the reaction mixture. It scavenged up to 60.4% superoxide radicals at a concentration of 500µg/ml. This scavenging activity of extract was equal to that of standard antioxidant BHA suggesting that this *Hibiscus rosa-sinensis* is a potent scavenger of superoxide [41].

The antioxidant activity of the extracts obtained in the hydro-ethanolic extraction measured in terms of IC₅₀ proved to be significant [42]. The total antioxidant activity of the crude extract and standard antioxidants (BHA, BHT and α -tocopherol) was determined according to the ferric thiocyanate method [43, 44]. Polyphenols are the major plant compounds with high levels of antioxidant activity. This activity could be due to their ability to adsorb, neutralize and to quench free radicals [45]. It was found that the crude extract of *Hibiscus rosa-sinensis* contains high level of phenol content that might account for the strong activity observed against ABTS radical cation(s) and hydrogen peroxide radicals. This scavenging activity may be due to the presence of hydroxyl groups attached to the aromatic ring structures and thus, help to quench the radicals [46].

Cytotoxic activity: There may be cytotoxic compounds in *Hibiscus rosa-sinensis* extract that can induce the cytotoxicity against cancer cells and initiate anti-proliferation effect leading to cancer cell death [47]. A previous investigation showed that the polyphenolics in methanolic flower extract exhibited significantly higher inhibitory effect on phosphatase enzyme activity in-vitro [48]. *Hibiscus rosa-sinensis* extract possessed a protective effect against the tumour formation stage of cancer development.

The potential ameliorative effect was determined in hyper-proliferation and oxidative damage caused by benzoyl peroxide and ultra-violet radiations in mouse skin. Pre-treatment with *Hibiscus rosa-sinensis* extract (3.5mg and 7mg/kg BW) partly restored the levels of cellular protective enzymes ($P < 0.05$). Melondialdehyde formation and hydrogen peroxide content ($P < 0.05$) were statistically reduced, dose dependently ($P < 0.05$) by the plant extract [49]. *Hibiscus rosa-sinensis* flowers contain anti-mitotic constituents that can stop the mitosis at any stage of cell-cycle. These constituents probably affect the cytoskeleton by tubulin polymerization or degradation [50]. Petroleum ether, ethyl acetate and methanol extracts of leaves and stem of *Hibiscus rosa-sinensis* (20-100 μ g/ml) was evaluated for in-vitro cytotoxic activity against leukaemic cancer cell line (K-562). Methanolic extract showed higher activity (IC₅₀ value: 30.9 \pm 1.1 μ g/ml) than other two extracts. Meanwhile, stem (methanolic) extract showed IC₅₀ value of 79.80 μ g/ml against K-562 cell lines [51]. Chloroform and aqueous extracts of flowers of *Hibiscus rosa-sinensis* showed cytotoxic effect against MCF-7 cell lines using MTT assay. Extract possessed marked percentage inhibition of cell-viability against MCF-7 cell lines in dose-dependent manner [52]. Aqueous extracts of flowers inhibited

melanoma cell growth at concentrations that did not affect the growth of non-transformed cells [53].

Anti-pyretic activity: *Hibiscus rosa-sinensis* has been traditionally used to treat fever. However, there are limited data to support this effect. This provides an alternative way to overcome the side-effects produced by chemically synthesized pharmaceutical medicines like NSAIDS [54]. The study showed anti-pyretic activity using leaves extract (aqueous and alcoholic) of *Hibiscus rosa-sinensis* [55].

Anti-depressant activity: The experiment of three different doses of ethanolic extract (100,250 and 500mg/kg, I.P) of *Hibiscus rosa-sinensis* were used to determine the anti-depressant effect. *Hibiscus rosa-sinensis* extract and standard drug (Fluoxetine 15mg/kg) induced significant diminution of mobility time in tail suspension test (control, 164.33±8.37; *Hibiscus rosa-sinensis* 100mg/kg, 155.6±4.6; 250mg/kg, 105.3±13.2; 500mg/kg, 89.6±7.8 and Fluoxetine 15mg/kg, 96.6±6.3) and concluded that all the doses of ethanolic *Hibiscus rosa-sinensis* extract showed significant anti-depressant effects [56].

Reproductive activity: Study showed the effects of ethanol, chloroform, ethyl acetate extract of *Hibiscus rosa-sinensis* on spermatogenesis and sperm parameters on mice. It significantly decreases the testis

weight, sperm count and sperm viability on administration of 125mg/kg BW of the extracts for three consecutive days [57]. When administered (I.P) two different dose (125 and 250mg/kg BW) of benzene, chloroform and alcoholic extracts of the flowers of *Hibiscus rosa-sinensis*, it decreased the spermatogenic element of testis and epididymal sperm count of adult male albino mice [58]. The effect of *Hibiscus rosa-sinensis* on oestrous cycle and reproductive organs was studied in female albino rats. The benzene extract of flowers disrupted the oestrous cycle. Treatment for 30 days resulted in significant reduction (effect was dose-dependent) in the weight of the ovaries, pituitary gland and uterus. Ovarian follicular atresia and uterine atrophy were observed [59]. The extract (benzene) showed oestrogenic activity in immature female mice by early opening of vagina, premature cornification of the vaginal epithelium and an increase in uterine weight. The flower extract administered intra-peritoneally at dose levels of 125, 250mg/kg BW to adult female mice, which resulted in an irregular oestrous cycle with prolonged oestrous and metestrus [60]. Study showed the postcoital antifertility properties of benzene hot extract of *Hibiscus rosa-sinensis* flower, leaves and stem barks. Only flower extract showed 100% prevention of pregnancy [61]. When

benzene extract of *Hibiscus rosa-sinensis* flowers was administered during day 1-4 of the gestation period, it exerted anti-implantation effect without affecting the tubal transport of zygote. On day 4, normal number of blastocyst was present, but not implanted. Ovarian structure exhibited signs of luteolysis [62]. On oral administration of benzene extract of flowers (1gm/kg BW per day from day 5-8 of gestation), caused termination of pregnancy in about 92% of female mice. This effect was associated with significant fall in peripheral level of progesterone and increase in uterine acid phosphatase activity, as measured on day 10. This extract caused the resorption of foetus by reducing the ovarian weight [63].

Anti-diabetic activity: The treatment in diabetic group was able to decrease the triglycerides and ALT levels compared to diabetic non-treated animals [64]. Study showed that anti-diabetic activities of aqueous ethanolic extract of *Hibiscus rosa-sinensis* and oral administration (500mg/kg) of aqueous extract to diabetic rats for 4 weeks, reduced blood glucose, urea, uric acid and creatinine but increased the insulin activities [65]. Evaluation was done with ethyl acetate fraction of *Hibiscus rosa-sinensis* petals in diabetic animals at a dose of 25mg/kg BW and compared with metformin. This showed the decrease in levels of serum glucose (398.56±35.78) and

glycated haemoglobin (12.89±1.89) in diabetic rats (156.89±14.45 and 6.12±0.49, respectively) [66]. Ethanol extract of *Hibiscus rosa-sinensis* was evaluated for hypoglycaemic activity; after a single dose of extract, a slight but insignificant hypoglycaemic effect was observed at 30 and 90 min., at 120 min. it was mild but significant. At 250mg/kg, the efficacy of this extract was 84% of tolbutamide (100mg/kg). Repeated treatment either with tolbutamide, a sulphonyl urea or *Hibiscus rosa-sinensis* showed 2-3fold improvement in glucose tolerance as compared to those receiving only once [67]. *Hibiscus rosa-sinensis* flower powder (2g, daily for 60 days) significantly decreased blood glucose level (mean fasting blood glucose), post prandial blood glucose level, mean glycosylated Haemoglobin level, mean total cholesterol, triglyceride level, total LDL and total VLDL cholesterol level [68].

Hypolipidemic activity: Anti-hyperlipidemic effect of ethanolic fractions of *Hibiscus rosa-sinensis* Linn. flowers were determined by triton induced and diet induced hyperlipidemic rats. Overall results suggested the LD50 value as 5000mg/kg. Hence therapeutic value (dose) was calculated as 1/10th (500mg/kg) of lethal dose. In triton induced model, the ethanolic extract (residual fraction) reduced serum lipid level (P<0.01). It reduced total cholesterol, triglycerides, phospholipids,

LDL, VLDL and increased HDL level [69]. Study showed the root extract exerted lipid-lowering effect and the effect was compared with a standard drug guggulipid (200mg/kg BW/day) [70]. Experiment with the extract of *Hibiscus rosa-sinensis* gave results for hypolipidemic effects as there was decrease in serum cholesterol and triglyceride levels and increased high density lipoproteins [71].

Anti-microbial activity: *Hibiscus rosa-sinensis* extract showed antibacterial activity against *Bacillus subtilis* and *Escherichia coli* (17.00 ± 2.91 & 14.50 ± 1.71) mm respectively (for cold extract) and *Escherichia coli* and *Salmonella sp.* (11.66 ± 3.14 & 10.60 ± 3.09) mm respectively [72]. Methanolic, chloroform, n-hexane and aqueous extracts of *Hibiscus rosa-sinensis* showed anti-bacterial activity against *Staphylococcus epidermidis* (11-23mm), *Bacillus subtilis* (13-26mm) and *Escherichia coli* (12-24mm). Extracts also exerted anti-fungal activity against *C. albicans* (12-20mm), *A. flavus* (10-17mm) and *C. glabrata* (0-19mm) [73]. *Hibiscus rosa-sinensis* leaves and flower extracts (95% ethanol, 20 μ l extract/disc) showed anti-Shigella dysenteriae effect [74]. *Hibiscus rosa-sinensis* (methanolic and ethanolic extract of petals) had strong activity against *Streptococcus mutans* (a dental pathogen) [76]. Flowers & root extract had activity against *Candida*

parapsilosis and *Aspergillus niger* at very low concentration [76].

Anti-tussive activity: Anti-tussive activity was evaluated by *Hibiscus rosa-sinensis* methanolic extract in histamine chamber using citric acid induced cough model [77].

Urinary effect: Anti-lithiatic potential was evaluated using aqueous extract of flowers [78]. Study showed that the extract (aqueous) increased the urine volume [79].

Protective effects: Study showed hepatoprotective effects against carbon tetrachloride-induced lipoperoxidation with *Hibiscus rosa-sinensis* petal partially purified anthocyanin extract [80]. *Hibiscus rosa-sinensis* showed haemoprotective activity against phenylhydrazine-induced haematotoxicity [81]. Study revealed the neuroprotective potential of methanolic extract and was evaluated in a Bilateral Common Carotid Artery (BCCA) occlusion model of global cerebral ischaemic reperfusion [82].

CONCLUSION

The current review described the phytochemical constituents, pharmacological effects and therapeutic importance of *Hibiscus rosa-sinensis* as a versatile medicinal plant with wide range of activities which can be utilised for further medical application because of its safety and effectiveness. Hence, significant investigation, evaluation and experiments

are required to exploit its therapeutic utility to treat various diseases.

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