International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

A Review on Phytochemical and Pharmacological Screening of *Hibiscus rosa-sinensis* L

Harshad Desai[1], Snehal Raut[2], Alpesh Patil[3], Abhishek Desai[4], Nilesh Chougule[5]

[1,2,3]Student, Ashokrao Mane Institute of Pharmacy, Ambap
[4]Assistant Professor, Department of Pharmaceutical Chemistry,Ashokrao Mane Institute of Pharmacy, Ambap
[5]Principal, Department of Pharmacology,Ashokrao Mane Institute of Pharmacy, Ambap

ABSTRACT:

Due to the rising disease burden, natural plant products are becoming popular today. The plant Hibiscus rosa sinensis Linn., which belongs to the Malvaceae family, is found all over the world. In India's traditional medicine, its leaves, barks, roots, and flowers have been used to treat a variety of illnesses. Numerous studies have demonstrated the antioxidant, antimicrobial, antidiabetic, antiulcer, hepatoprotective, antifertility, antigenotoxic, and antiinflammatory qualities that the various sections of Hibiscus rosa sinensis plants contain, which aid in the treatment of a variety of ailments. Numerous herbal concoctions and beverages contain hibiscus rosa sinensis. Numerous studies using animal models analyze the flowers and leaves of Hibiscus rosa sinensis for their anti-diabetic and antioxidant properties. This review makes an effort to highlight the medicinal uses of Hibiscus rosa sinensis.

Keywords: Hibiscus rosa sinensis Linn, hepatoprotective, antioxidant

1. INTRODUCTION:

Numerous herbs and medications are found in nature, and many drugs have been isolated from it. India is a diverse country with extensive traditional medicinal practices. Ayurveda, Unani, and Siddha are the traditional medical practices that are most widely accepted. In the formulations of these systems, natural herbs are used. Various other names for Hibiscus rosa sinensis include Chinese Hibiscus, tropical Hibiscus, etc. It is a member of the Malvaceae family. This perennial ornamental shrub can be found all across the tropics. The plant is around 7 to 2 feet tall. Although it comes in a variety of colors, red flowers are preferred for their therapeutic properties. Rosa sinensis is Latin for "rose of China." Hibiscus rosa sinensis has a wide range of applications, including pharmacological,uses in medicine and cosmetics. As a natural treatment, the juice squeezed from leaves and blooms is used to treat a variety of illnesses. It is utilized to create shoe polish and eyeliner. The flower and leaf both exhibit analgesic, antioxidant, and antifungal qualities, which have already been demonstrated by numerous research. The herb is said to have anticancer qualities, according to studies. It is able to eliminate free radicals that might harm DNA. Hibiscus rosa sinensis has a number of important chemical components, including cholesterol, compestrol, stigmasterol, glucose, fructose, flavanoids, hibiscetin, cyanin, glycosides, and alkanes [01–03].

Figure 1: Hibiscus flowers

Table 1: Scientific classification of Hibiscus rosa sinensis Linn [04]

Kingdom	Plantae
Subkingdom	Tracheobionta
Division	Megnoliophyta
Class	Magnoliopsida
Subclass	Dilleniidae
Order	Malvaceae
Genus	Hibiscus
Species	Hibiscus rosa sinensis

Table 2: Description of Hibiscus rosa sinensis[05]

1	Biological source	it is obtained from flwers and leaves of Hibiscus rosa sinensis Linn
2	Family	Malvaceae
3	Common name	Chembarathi(Malayalam),Semparutti(Tamil), Rudrapuspa(Sanskrit). Gurhal(Hindi), Shoe flower plant, Chinese hibiscus(English)
4	Soil condition	Preferably sandy and loamy clay and well-drained soil.
5	Propagation	Cutting, layering or grafting in springs.
6	Origin and distridution	Native to tropical Asia, China and Philippines. This is the national flower of Malaysia.
7	Leaves	Simple ovate or ovate lancolate in shape and are rich in mucilage.
8	Flowers	Corolla consists of five petals. They are pedicillate, actinomorphic and complete in nature

9	Chemical constituents	Flowers: Ascorbic acid, Thiamine, Citric acid, Glucose, Fructose, Oxalic acid and Riboflavia Leaves: Alkaloids, Reducing sugars, Fatty acid, Fatty alcohol, Glycosides, Resins and Hydro carbons.

2. PHYTOCHEMISTRY:

The plant h. rosa sinensis has a variety of chemicals in every component. Phlobatenins, terpenoids, along with other substances like thiamine, riboflavin, and neocin, have reportedly been found in leaves, flowers, stems, and roots. [06]The leaves contain 7.34 mg of fresh material per 100 mg.Fatty alcohols and hydrocarbons from the leaves of the hibiscus rosa sinensis have been identified by Srivastav, Bhatt, and Uduva. These include undecanoic acid, pentadecanoic acid, ticosanoic acid, octadecadianoic acid, octacasanoic acid, n- ti cosane, tri acontane, n N-dotricontae, nicosane, etc. [07] According to reports, catalase is found in the petals of ptanaic. [08]

The results of an analysis of the flower's edible component (61.6%) were as follows: Values: 89.8% moisture, 0.064 nitrogen, 0.36 fat, 1.56% crude fiber, 4.04% calcium, 26.68% phosphorus, and 1.69 mg of iron per 100 mg. [09] Flower flavones, including quercetin-3,5diglucocide, quercetin-3,7-dicluside, cynidine-3,5diglucocide, and cinidine-3-sophorocide All of the aforementioned chemicals were isolated from deep yellow flowers, including 3- to 5-diglucocide[10]. Additionally, thiamine (0.031 mg%), riboflavin (0.048 mg%), niacin (0.6 mg%), ascorbic acid (4.16 mg%), apigenidine, citric acid, fructose, glucose, oxalic acid, palargodine, and quinine are also present in the blossoms. Teraxeril acetate, -sitosterol, and the cyclic acids sterculic and malvelic acids are all produced by the leaves and stems [11]. [12]

Traditional Uses of Hibiscus rosa sinensis

- Cough suppressing properties of Hibiscus rosa sinensis Linn's roots.
- You can use leaves and flowers to boost hair development, stop premature graying, and treat scalp conditions. • The leaves have emollient qualities and can be used to treat diarrhea and dysentery.
- According to reports, the flowers are effective in treating conditions like leprosy, diabetes, epilepsy, and heart problems.
- Venereal illnesses can be treated using the root's decoction. • After childbirth, leaves can be used as an abortifacient and to encourage placenta ejection.
- The leaves and roots can be utilized to increase blood flow, which helps to control menstruation.
- Hibiscus rosa sinensis blossoms can becan be used to treat liver disorders, high blood pressure, stomach pain, and other conditions.
- Hibiscus rosa sinensis has diuretic properties.
- The fruits can treat wounds, sprains, and other conditions [13][14].

Pharmacological Activities of Hibiscus rosa sinensis

Antioxidant activity:

Rajesh mandate, S.A.Sreenivas, and others revealed that the crude extract of hibiscus Rosa sinensis shown antioxident action. Butylated hydroxytoluene and tocoferol are two examples of compounds that act as antioxidant radical scavengers and are used as references. 94.58% of the oxidants in linoleic acid

emulsion, including BHA, BHT, and tocoferol, are restricted at a specific concentration of 60 m/ml. Hibiscus rosa sinensis crude extract contains natural antioxidants and exhibits beneficial effects. [15]. Any substance that has the capacity to eliminate them, such as the phytochemical found in H. rosa sinensis, will shield the cell system and its constituent parts from cytoxic harm. [16] [12]

Anti-bacterial activity:

It has been demonstrated that the H. rosa-sinensis leaf methanol extracts had antibacterial effects on Pseudomonas aeruginosa, Escherichia coli, Enterobacter aerogenes, and Streptococcus pyogenes. The largest observed zone of inhibition was 13 mm and it was against E. coli after a 24-hour incubation period at 37° C, followed by 12 mm against both S. aureus and E. aerogenes at an 80 g/ml concentration of leaves methanolic extract [17].

These microorganisms were taken from sick skin, and the study's identification of flavonoids, tannins, terpenoids, saponins, and alkaloids may be to blame for the chemical compounds that have the antibacterial action [17].

Aqeous leaf extracts of 40 mg/ml demonstrated the greatest zones of inhibition against Bacillus subtilis (14.00 1.05 mm), E. coli (12.30 0.95 mm), and S. aureus (11.00 1.20 mm) in a different study using the disc diffusion method, whereas methanol extract demonstrated the greatest zones of inhibition following 48 hours at 34° C. against B. subtilis (18.82 0.18 mm), E. The previously mentioned cardiac glyxosides, anthraquinones, and phlobatanins were among the phytochemicals that were examined [18]. Surprisingly, another study foundSimilar results were observed, with hexane extracts providing the highest zone of inhibition against B. subtillis at 19.86 0.15 mm and E. coli at 18.00 1.53 mm [19]. Aqueous extracts had a maximum zone of inhibition against B. subtillis of 15.00 2.81 mm and E. coli of 12.50 1.81 mm. Although the same protocol was utilized, flowers from H. rosa sinensis were used in this study, and the results were seen after only 24 hours of incubation [19].

Using the disc diffusion method, antibacterial activity against E. coli and S. aureus has also been seen at various doses of methanolic flower and leaf extracts, ranging from 31.25 to 500 mg/ml. These were contrasted with gentamicin (1 mg/ml), a positive control, and methanol, a negative control [30]. The bactericidal activity of both types of extracts increased with extract concentration. The maximum zones of inhibitions for E. coli were 23 1.01 mm and 13.75 0.99 mm for leaf and flower methanolic extracts, respectively, at a dosage of 500 mg. For S.aureus, however, methanolic leaf and flower extracts had the greatest zones of inhibition at 500 mg concentrations, measuring 19.33 0.29 mm and 9.75 0.76 mm, respectively [20]. This study used flower extracts to identify the carbohydrates, phytosterols, and proteins they contained. and glycosides, tannin, phenols, and flavonoids from leave extracts. However, alkaloids and saponins were found in both extracts [20].

Antifungal activity:

Previous research has demonstrated that methanol extracts made from Hibiscus rosa-sinensis leaves have antibacterial effects on Trichophyton rubrum, Candida parapsilosis, Aspergillus niger, Candida albicans, and the fungus Candida albicans. The maximum observed zone of inhibition using the well diffusion method was 9.3 0.57 mm against Aspergillus niger after a 24-hour incubation period at 37° C, and it was followed by 6.6 0.57 mm against Candida albicans at an 80 g/ml concentration of leaves methanolic extract [17]. These fungi were acquired from sick skin, and the study's identification of flavonoids,

tannins, terpenoids, saponins, and alkaloids may be to blame for the chemical compounds that have the antifungal action [17].We also looked into the antifungal properties of H. rosa sinensis root, leaf, and flower ethanol extracts. According to a study utilizing the disc diffusion method, floral extracts, at a dosage of 10 g/ml, had the largest zones of inhibition, inhibiting the growth of both Candida parapsilosis and Aspergillus niger for 1.5 cm [21]. Additionally, extracts from the leaves prevented Candida parapsilosis at optimal levels for 2.2 cm and 1.5 cm, respectively, at concentrations of 10 g/ml and 7.5 g/ml [21].

At a dosage of 100 mg/ml, H. rosa sinensis methanol leaf extracts also prevented the development of Candida albicans for 20 mm, C. glabreta for 19 mm, and A. flavus for 17 mm [34]. Moreover,Flower extract was discovered to be effective against all tested fungus, with the exception of Aspergillus flavus, using the agar disc diffusion method. Aspergillus niger (9 mm), Aspergillus terreus (17 mm), Aspergillus oryzae (17 mm), Fusarium solani (10 mm), Fusarium verticillioides (13 mm), and Penicillium sp. (15 mm) had the largest inhibitory zones, according to research [22].

Anti –inflammatory activity:

Ethenol extract of dried leaves, given intraperitoneally to rats at a concentration of 100.0 mg/kg, was active in preventing carregenin-induced pedal edema. [23]. Hibiscus rosa sinensis' anti-inflammatory properties are explained by Vivek Tomer et al. Hibiscus rosa sinensis treats a wide range of inflammatory disorders, including blenorrhea, asthmatic bronchitis, and oaral mucosa inflammation. The methanolic extract of hibiscus rosa sinensis leaves was employed for anti-inflammatory properties. Dextran causes inflammation and is used as a stander against caarragen. [24]

Anti-diabetic activity:

The alcohol leaves extract of Hibiscus rosa sinensis was shown to be an oral hypoglycemic agent in non-obese type I diabetic mice. Using concentrations of 100 and 200 mg/kg of body weight, it decreased blood glucose levels from 281.6 3.7 mg/dI to 92.2 2.63 and 83.8 3.15 mg/dI, respectively, in contrast to 103.37 2.13 mg/dI in insulin-injected NOD mice, which was utilized as the positive control [25]. After 5 weeks of oral dosing, the studied extracts also dramatically decreased levels of triglycerides, blood urea, glycosylated hemoglobin, and cholesterol [25]. Root extracts of 500 mg/kg of bw concentration decreased blood glucose levels in alloxan-induced type II diabetic rats (150 mg/kg) from 300.23 32.20 to 220.41 20.40 mg/dl, compared to 175.38 11.67 mg/dl in glibenclamide.

Investigations were also conducted on the H. rosa sinensis ethanolic leaf extracts' potential ability to treat rats with alloxan-induced diabetes. In contrast to metformin-treated rats, whose blood glucose levels dropped from 16.94 0.51 to 12.90 0.38 mmol after 4 hours, it was shown that at 2 mg/kg bw, blood glucose levels decreased from 17.5 0.69 to 13.8 0.36 mmol [27]. 400 mg/kg of a methanolic extract of leaves was able to reduce blood glucose levels in streptozotocin-induced diabetic rats from 326.67 25.76 to 154.11 17.91 mg/dI. In addition, it decreased levels of uric acid, creatinine, AST (aspartate aminotransferase) (AST), and ALT (alanine aminotransferase), indicating protective effects on the kidneys and liver, which were supported by H&E histological investigation [28]. Interestingly, the combination of orientin and verbascoside (phenylpropanoids glycoside) (Luteolin-8-C-glucoside) that were identified by NMR spectroscopy, are highly responsible for this anti-diabetic activity [28].

In a different study, hyperlipidemic Wister rats exposed to alloxan-induced diabetes showed the highest antidiabetic and anti-hyperglycemic effects when treated with 500 mg/kg of ethanolic floral extract [29]. This was also observed when the impact of flower aqueous extract on pregnant female rats was assessed. Prior to mating, streptozotocin was used to make these Wister rats diabetic. Although the non-diabetic pregnant rats did not benefit from the medication, the pregnant diabetic rats and their progeny did [30]. By extending the treatment duration and switching to alloxan, this trial may have been conducted more effectively and fairly because blood glucose levels would have climbed more gradually [30].With all graded doses of 50, 100, and 200 mg/kg, flower ethanol extracts were able to gradually lower blood glucose levels in albino rabbit study models over the course of 72 hours. The positive control drug, glibenclamide (200 mg/kg p.o.), generated a rapid drop in blood sugar levels over the course of 24 hours, which is undesirable in clinical settings [31]. In clinical trials, type II diabetes mellitus individuals between the ages of 30 and 60 were given 2 g of the flower's powder to see if it had any antidiabetic effects. Fasting blood glucose levels decreased from 147.8 43.54 to 111.6 35.32 mg/dI after daily oral treatment for 60 days [32]. Additionally, postprandial glucose levels decreased from 184.6Compared to no change in the control groups, the range for both cases was 6 81.86 to 126.5 34.14 mg/dI. Additionally, significant reductions in total cholesterol and triglyceride levels were produced by the flower's powder [32].

Anti-cancer activity:

75 and 125 mg of H. rosa sinensis oil extract were applied to oral cancer cell lines KB (ATCC CCL-17) for 24 hours. The DNA of the treated cells from both concentrations has been found to be fragmented in comparison to the control sample after the treated cells were subjected to a DNA fragmentation assay and agarose gel electrophoresis. This indicates that Hibiscus extract reduced oral cancer cell growth and proliferation [33]. Additionally, it was demonstrated that HT-29 colorectal AGS cell lines were completely suppressed by 250 g of 90% methanolic leaves extratc. The MTT assay was used to measure the cell viability percentage, and the determined IC50 value of 90.79 g/ml was discovered. According to the phytochemical analysis, flavonoids were primarily responsible for this strong anticancer action. due to flavonoids and terpenoids content in the leaves [34].

The vitality of HeLa cell lines was examined in relation to acetone extracts of H. rosa sinensis flowers. A concentration of 1000 g/ml resulted in only 12.96% cell viability, according to the MTT experiment. This action is thought to be caused by the presence of flavonoids, tannins, and saponins, which have been identified by FT-IR spectra and qualitative screening tests [35].

After 72 hours of incubation using MTS and MTT tests, methanolic leaf extracts shown a greater activity against K-562 leukemic cancer cells, yielding an IC50 value of 30.9 1.1 g/ml compared to petroleum ether (IC50 of 87.6 0.91 g/ml) and ethyl acetate extracts (IC50 of 57.6 0.61 g/ml However, IC50 for methanolic stem extracts was 79.80 g/ml as opposed to IC50 for petroleum ether and ethyl acetate extracts of over 100 g/ml. MDBK (Mardin-Darby kidney) cells were employed in this work as a positive control and provided an IC50 value of greater than 100 g/ml for all extracts. Hoescht staining's morphological detection of the anticancer activity revealed that treatment of K562 cells with 30 g/ml of methanol leaf extract resulted in apoptosis with nuclear segmentation after 24 hours of incubation [36].

Four cancer cell lines—breast MCF-7, liver HepG2, lung NCI-H23, and colon HT-29 cancer cells—were used to examine the effects of aqueous leaf extract [37]. The extract suppressed the growth of

HepG2 cells by 54.7%, HT-29 cells by 54.6%, and MCF-7 cells by 51.5% when used at a dose of 200 g/ml, compared to NCI-H23 cells, which were only inhibited by 49.2%. Tamoxifen, the positive control utilized for MCF-7 cells, caused an inhibition of 85.4%, whereas 5-Fluoro Uracil, the positive control used for other cell lines, caused an inhibition of 88.6% [37]. Similar to this, after 72 hours of incubation, aqueous floral extract decreased the proliferation of B16F10 melanoma cells by 2 folds at 1 mg/ml and by 4 folds at 2 mg/ml. However, it had no effect on Src kinase activity in LA25 melanoma cells, a possible chemotherapeutic target. This study hypothesizes that the biocompounds in the extract have an impact on other pathways involved in tumor cell viability [38].

3. CONCLUSION

The present study demonstrates beneficial effects of this plant extract. The activities of plant demonstrated in diabetic pregnant rats, in both mothers and their offspring, and no benefits were identified in non-diabetic rats. However, although these findings cannot be extrapolated to humans, they show that the indiscriminate intake of H. rosa-sinensis extract may be harmful to healthy individuals and its use should be completely avoided in pregnancy. Various Pharmacological activities plant H.rosa-sinensis were found. These activities are Anti-bacterial, Anti-fungal, Anti-inflammatory, Anti-diabetic, Anti-oxidant, Anti-cancer.

REFERENCES:

1. Jani GK, Shah DP. Evaluation of mucilage of Hibiscus rosa sinensis Linn as rate controlling matrix for sustained release of diclofenac. Drug development and industrial pharmacy. 2008 Jan 1;34(8):807-16.
2. Upadhyay S, Upadhyay P. Hibiscus rosa sinensis: pharmacological review. International Journal of Research in Pharmaceutical and Biomedical Sciences.2011;2(4):1449-50.
3. Jadhav VM, Thorat RM, Kadam VJ, Sathe NS. Hibiscus rosa sinensis Linn–‘‘Rudrapuspa’’: A Review. J Pharm Res. 2009; 2(7):1168-73.
4. Pekamwar SS, Kalyankar TM, Jadhav AC. Hibiscus rosa-sinensis: A review on ornamental plant. World Journal of Pharmacy and Pharmaceutical Sciences. 2013;2(6):4719-27.
5. Jadhav VM, Thorat RM, Kadam VJ, Sathe NS. Hibiscus rosa sinensis Linn–‘‘Rudrapuspa’’: A Review. J Pharm Res. 2009; 2(7):1168-73.
6. Salem MZ, Olivarese-perez j, Salem AZM.Studied on biological activities and phytochemicles composition of Hibiscus species – review. Life science .2014;11(5):1-8.
7. Khare,C.P.Encyclopedia of india Medicinal plant s, Sringervella berlin Heidelberg,New york ,2004 248-249
8. Srivastava, D.N., Bhatt,S.K. and Udupa,K.N.gas cromatographic identificationof , Fatty alcohalsl and hydrocarbon of hybiscus rosa sinensis leaves J Amer.Oil chem soc.53:1976,607.
9. The Wealth of India –Raw materials, Vol -5, Council of scientific and Industrial Research, New delhi ,1992 ,91-92.
10. Joshi,s.g., medicinal plant,Oxford and IBH Publishing Co. Pvt. Ltd.New Delhi ;2004,255
11. Khare,C.P.Encyclopedia of india Medicinal plant s, Sringervella berlin Heidelberg,New york ,2004 248-249
12. M P Prasad,In vitro Phytochemical analysis and antioxidant activities of hibiscus species , Int ,J.Pure appl.bioscience 2(3)(2014),8388.

13. Al-Snafi AE. Chemical constituents, pharmacological effects and therapeutic importance of Hibiscus rosa-sinensis-A Review Journal of Pharmacy.2018;8(7):101-19.
14. Sargam, Dharmendra Kumar, Garima Garg. Pharmaceutical and pharmacological activities of Hibiscus rosa sinensis mucilage. The global journal of Pharmaceutical Research. 2013;2(3):1822-29.
15. Mandede rajesh ,Sreenivas S.A. ,Sakarkar D. M. and chaudhary avijit: radical scavenging and antioxident activity of hibiscus activity hibiscus rosa sinensis extract .African journsl of pharmecy and pharmcology 2011;(17),2027-2034.
16. Kholkhute S.D., Chatterji ,S.and udupa K. N., effect of hibiscus rosa sinensis linn on Oestrues cycle and reproductive in rats ,Indian J expr.Bio.14:1976,703-704 .
17. Hemarana K, Jeyashree KV, Babu M, Kannan M. Preliminary bioactive compounds screening and antibacterial activity of methanolic extract of Hibiscus rosa sinensis against selected skin pathogens. . Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2014;5(2):1210–1218.
18. Udo IJ, Ben MG, Etuk CU, Tiomthy AI. Phytochemical, proximate and antibacterial properties of Hibiscus rosa-Sinensis L. Leaf. Journal of Medicinal Plants Studies. 2016;4(5):193–195.
19. Agarwal S, Prakash R. Evaluation of antibacterial activity of Hibiscus rosa-sinensis flower extract against E. coli and B. subtillis. Biological Forum – An International Journal. 2014;6(2):194–196.
20. Tiwari U, Yadav P, Nigam D. Study on phytochemical screening and antibacterial potential of methanolic flower and leaf extracts of Hibiscus rosa sinensis . International Journal of Innovative and Applied Research. 2015;3(6):9–14.
21. Kumari OS, Rao NB, Reddy VK. Phyto-chemical analysis and antimicrobial activity of Hibiscus rosa-sinensis . World Journal of Pharmacy and Pharmaceutical Sciences. 2015;4(5):766–771.
22. Nilima W, Deepavali S. Antifungal activity of selected plant extracts against important seed borne fungi of maize. International Journal of Pharma and Bio Sciences.
23. Singh N.R. Nath ,A.K.and Agrawal.R.P.A pharmacological invevstigation of some indigenous drugs of plants origin for evaluation of their antipyratic, analgesic anti inflemmatory activitiies ,J.Res.Indian Med.Yoga Homeopathy ;13: 1978, 58-62.
24. Tomar vivec Kannaujia P,jain .K.N.Dube K.s.:Antinoceptive and antiinflemmatory activity of leves of hibiscus rosa sinensis .Inernational Journal of research in ayurveda and Pharmecy.2013;4(3):163–170.
25. Moqbel F, Naik PR, Najma HM, Selvaraj S. Antidiabetic properties of Hibiscus rosa sinensis L. leaf extract fractions on nonobese diabetic (NOD) mouse. Indian journal of experimental biology. 2011;49(1):24– 29.
26. Kumar V, Mahdi F, Khanna AK, Singh R, Chander R, Saxena JK, et al. Antidyslipidemic and antioxidant activities of Hibiscus rosa sinensis root extract in alloxan induced diabetic rats. Indian Journal of Clinical Biochemistry. 2013;28(1):46–50.
27. Al Mamun, Islam S, Alam K, Abdur Rahman A, Rashid M. Effects of ethanolic extract of Hibiscus rosa-sinensis leaves on alloxan-induced diabetes with dyslipidemia in rats. Bangladesh Pharmaceutical Journal. 2013;16(1):27–31.
28. Zaki LH, Mohamed SM, Bashandy SAE, Morsy FA, Tawfik KM, Shahat AA. Hypoglycemic and antioxidant effects of Hibiscus rosa sinensis L. leaves extract on liver and kidney damage in streptozotocin induced diabetic rats. African Journal of Pharmacy and Pharmacology. 2017;11(13):161–169.

29. Ghosh A, Dutta A. Antidiabetic effects of ethanolic flower extract of Hibiscus rosa sinesis (L) on alloxan induced diabetes in hyperlipidaemic experimental Wister rats (WNIN). International Journal of Engineering Development and Research. 2017;5(4):674– 679.
30. Afiune LAF, Leal-Silva T, Sinzato YK, Moraes-Souza RQ, Soares TS, Campos KE, et al. Beneficial effects of Hibiscus rosa-sinensis L. flower aqueous extract in pregnant rats with diabetes. PLoS One. 2017;12(6):1–13.
31. Pethe M, Yelwatkar S, Gujar V, Varma S, Manchalwar S. Antidiabetic, hypolipidimic and antioxidant activities of Hibiscus rosa sinensis flower extract in alloxan induced diabetes in rabbits. International Journal of Biomedical and Advance Research. 2017;8(4):138–143.
32. Sharma K, Pareek A, Chauhan ES. Evaluation of hyperglycemic and hyperlipidemic mitigating impact of Hibiscus rosa sinensis (gudhal) flower in type ii diabetes mellitus subjects. International Journal of Applied Biology and Pharmaceutical Technology. 2016;7(2):223–228.
33. Hinaz N, Gayathri R, Priya VV. Genotoxicity of Hibiscus rosa sinensis on oral cancer cell line. International Journal of Pharmaceutical Sciences Review and Research. 2017;44(1):21–23.
34. Divya MJ, Sowmia C, Dhanya KP, Joona K. Screening of antioxidant, anticancer activity and phytochemicals in methanolic extract of Hibiscus rosa-sinensis leaf extract. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2013;4(2):1308– 1316.
35. Durga R, Kumar PS, Hameed SAS, Dheeba B, Saravanan R. Evaluation of in-vitro anticancer activity of Hibiscus rosa sinensis against hela cell line. Journal of Global Pharma Technology. 2018;10(1):1–10.
36. Arullappan S, Muhamad S, Zakaria Z. Cytotoxic activity of the leaf and stem extracts of Hibiscus rosa sinensis (malvaceae) against leukaemic cell line (k-562). Tropical Journal of Pharmaceutical Research. 2013;12(5):743–746.
37. Basha DP, Ravishankar K, Kiranmayi GVN, Subbarao M. Antitumour activity of Hibiscus rosa-Senensis. World Journal of Pharmacy and Pharmaceutical Sciences. 2013;2(6):4987–4996.
38. Goldberg KH, Yin AC, Mupparapu A, Retzbach EP, Retzbach EP, Goldberg GS, et al. Components in aqueous Hibiscus rosa-sinensis flower extract inhibit in vitro melanoma cell growth. Journal of Traditional and Complementary Medicine. 2017;7(1):45–49