

PHARMACOLOGICAL EFFECTS OF *RHEUM EMODI*: A MULTIPLE PURPOSE PLANT IN HEALTH AND DISEASE

Muhammad Daniyal^{1*}, Wei Wang¹, Liu Bin², Babatunde Oluwafemi Adetuyi³

Abstract: *Rheum emodi* (Polygonaceae) is also known as Himalayan or Indian Rhubarb. It has been used in traditional system of medicine as a diuretic, tonic, laxative and also used to manage pyrexia, menstrual disorders, indigestion and cough since antiquity. This article comprises of pharmacological studies, chemical properties, folkloric uses and ethnobotany of *Rheum emodi*. The material was obtained from books and journals via electronic and library search. The most important ingredients of *Rheum emodi* are resveratrol, picetannol, stilbene, physcion, emodin, aloe-emodin, chrysophanol, and rhein. Studies have indicated that *Rheum emodi* possesses nephroprotective, immune-enhancing, hepatoprotective, anti-ulcer, spasmolytic, antiviral, cathartic, anti-hyperglycemic, antihyperlipidemic, antifungal, antimicrobial, anti-inflammatory, antioxidant, antiplatelet and anticancer activities. Further study to explore the medicinal potential of this plant may lead to the development of novel drugs for numerous disorders. This review concluded that *Rheum emodi* requires proper evaluation to establish its therapeutic role in modern medicine.

1. TCM and Ethnomedicine Innovation & Development International Laboratory, Innovative Materia Medica Research Institute, School of Pharmacy, Hunan University of Chinese Medicine, Changsha, 410208, China
2. College of Biology, Hunan University, Changsha, 410082, China
3. Department of Natural Sciences Faculty of Pure and Applied Sciences Precious Cornerstone University, Nigeria

Corresponding Author:

daniyaldani151@gmail.com

Keywords: *Rheum emodi*, Himalayan Rhubarb, Indian Rhubarb, pyrexia, menstrual disorders, antiplatelet, polygonaceae

INTRODUCTION

Rheum emodi; literally familiar as strange rhubarb and foreign rhubarb exhibits topographical diversity regarding its title. Rhubarb acquires its name from Latin word “rha” (river) & “barb” (barbarian land) by virtue of its importation from barbarian lands across Volga / Rha River in classical days. Its divergent names on the subject of tongues are Latin name: *Rheum emodi*, English name: Rhubarb, Arabic name: Rewandfarnasawi, Urdu name: Rewandchini, Family: Polygonaceae (Table 1). A robust perennial herb having an altitude of upto 3 m with thick,

long, roots; 1-15 m tall grows on rocky lands and near brooks throughout subtropical and temperate zones of Himalayas. Roots are stout and the stem is hollow with green hue and brownish streaks. Lower leaves are 20-50 cm in diameter, orbicular and are broadly ovate. Flowers with a diameter of 3 mm are small and dark purple in color being perceived in the days of July- August. Fruits with a gauge of 11-12 mm, springing up in the days of September October, are purple and angled (1). The plant is found in Sikkim, Kashmir, and Himalayas at altitudes of 3300-5200 m. In Himachal Pradesh, it is observed growing in Bara and Chhota

Bhangal of Kangra; Parvati valley of Kullu, Pangi Bharmour of Chamba, Dodra of Kwar, Rohru ranges of Shimla districts and Khashadhar, Lahaul, Kinnaur and Spiti districts (2). Furthermore, the medicinal herb is farmed in China, Tibet, Germany and other European countries besides its cultivation in Assam in the characteristic of edible foodstuff. It contains phytochemicals such as aloe emodin, anthrones, anthraquinone derivatives, carbohydrates, catechin, emodin, 6-methoxy chrysophanol, chrysophanol, chrysophanein, cinnamic acid, epicatechin, flavonoids, gallic acid, gallate, glucogallin, glycosides, glucoemodin, glucorhein, leucocyanidin, lignins, oxalic acid, palmidin-A, palmidin-B, palmidin-C, phenols, picetannol, physcion, oxanthrone esters, resveratrol, rhein, revandchinone, stilbenes and tannins (Table 2) (3). It is used in ring worm, moles, freckles, naevus, bruises, pain, coryza, asthma, chronic fever, chronic bronchitis, piles, sore eyes, biliousness, ulcer, loss of appetite and dysentery. It possesses antibacterial, antifungal, antioxidant, anti-inflammatory and anticancer activities (4). It is also prescribed in constipation and its main effect is to increase intestinal movements. It is alternative and hemostatic. It is antipyretic and used in all types of fever. It is also prescribed in intestinal worm infections. It relieves stomach pain and is prescribed in gastrointestinal disorders (5). *Rheum emodi* has been traditionally used for the treatment of various illnesses such as pyrexia, hepatic disorders, jaundice, fungal infection, bacterial infection, ulcers, and dysmenorrhea (6). Some researchers have worked on pharmacology activities of *Rheum emodi*. The data indicates that

Rheum emodi may have an immune modulating potential through the release of different cytokines. *Rheum emodi* root is prescribed in constipation. Its anthelmintic activity has been reported. It has been prescribed as a hepatoprotective agent. It has antioxidant activity (7). It is effective in nausea and vomiting. It is prescribed in jaundice and ailments of eyes.

USES OF RHEUM EMODI

Rheum emodi is a medicinal herb usually known as Himalayan rhubarb is widely used in Chinese, Unani and Ayurvedic system of India (14). It has been cultured over 5,000 years owing to its exceptional healing properties. Avicenna advocated the application of *Rhubarb* in almost all systems of the soma. The monetary worth of Revandchini in Europe and France has also been appraised its dignity. Dioscorides and Galen illustrated the desired medicinal traits of the subject matter in their contents. Nowadays we have new and different types of medicines originated from natural sources which are well suited to the human body with a minute or no toxic side effects for curing the different diseases and *Rheum emodi* is one of those naturally occurring medicines. It is considered as astringent, tonic, purgative, stomachic (2, 8) and emmenagogue, diuretic and laxative. Its root is considered as appetizer and expectorant. It is used externally for the treatment of joint pain, Rheumatoid arthritis, and ascites (13). *Rheum emodi* acts as antiseptic, antitumor, chalogogue, antispasmodic, and anticholesterolemic (7). Blood stagnation related to bruise and stabbing pain and type II Diabetes is treated by roots and rhizomes of *Rheum emodi* (15). Rhizome's extract also has

anti-cancerous and antioxidant activity (2). It is investigated that due to the presence of a large number of flavonoids it possesses hepatoprotective activity (16, 17). The root powder is used with honey to treat rhinitis and cough, chewing the root is also a good way of taking it. The root powder is sprinkled on ulcers for quick healing and for cleaning the teeth (8). It is efficiently tolerated in combination with magnesium/sodium bicarbonate in presenting with exaggerated bowels due to unprocessed food. For sluggish bowels, powdered root is mixed with ginger and given in the form of pills (6). Besides its therapeutic applications, it is practiced for culinary reasons as well. Because of its tart content, it is used in the preparation of jelly, sauces, beverages and other desserts as a flavoring agent. Its leaf stalk is used as a fresh salad and as a vegetable for cooking (18).

PHARMACOLOGICAL ACTIVITIES

Dyeing red color on wool and silk clothes, roots of *Rheum emodi* are used (Table 3).

HYPOGLYCEMIC ACTIVITY

It has hypoglycemic activity and it is prescribed golden hue on the application, therefore can be to treat diabetes mellitus. Hypoglycemic action (used as a bleaching agent) of *Rheum emodi* has been reported in the previous study. Arvindekar et al (2004) reported Himalayan Rhubarb *Rheum emodi* to possess alpha-glucosidase inhibitor ingredients that helps in decreasing absorption of glucose from the intestine (21). It inhibits gluconeogenesis and promotes peripheral utilization of glucose.

HEPATOPROTECTIVE ACTIVITY

This plant has hepatoprotective activity and antifungal activity. This plant has antifungal activity and it is prescribed to treat fungal infections induced by *Candida albicans*, *Aspergillus fumigatus*, *Cryptococcus neoformans*, *Trichophyton mentagrophytes*, *Aspergillus niger* and *Rhizopus coryzae*. Antifungal and other compounds were isolated from the roots of New Zealand flax plants (the genus *Phormium* (24). Antifungal activity of anthraquinone derivatives from *Rheum emodi* has been reported (25).

ANTICANCER ACTIVITY

This plant is prescribed to treat cancer. This is commonly used to treat cancer of kidney and bladder. Rajkumar et al (2011) reported the anticancer and antioxidant effects from rhizome extracts of *Rheum emodi*. Antioxidant and anticancer potentials of *Rheum emodi* has been reported in a previous study (2). Rajkumar et al. (2011) investigated the cytotoxicity of aqueous and methanolic extracts of the *Rheum emodi* against liver carcinoma and human breast carcinoma (MDAMB-435S) cell lines. The study indicated that *Rheum emodi* has dose-dependent cytotoxicity against cancer (26).

ANTIBACTERIAL ACTIVITY

This plant is used to treat gastrointestinal disorders since ancient times. This plant has antibacterial activity and is prescribed to treat peptic ulcer. *Rheum emodi* extract was investigated for its activity against *H. pylori*. This was *in vitro* and *in vivo* study. Petroleum, ether, benzene, ethanol, and chloroform extracts were used for the study. Male Wistar rats were used in *in vivo* study and in *in vitro*

study was done by using disk diffusion method. The extract was effective against all 30 resistant isolates of *H. pylori*. Ethanol and benzene extracts of this plant inhibited *H. pylori* at very low concentrations. In the *in vivo* study, *Rheum emodi* was active at a dose of 3 mg/ml against *H. pylori* infection when given orally for seven days. This study indicated that extract inhibited *H. pylori* growth *in vitro* and *in vivo* studies within seven days (5).

ANTIULCER ACTIVITY

The antiulcer potential of ethanolic extract of *Rheum emodi* rhizome was evaluated on ulcers induced by pyloric ligation in rats. It was observed that there was decrease in ulcer index along with the decrease in total acidity and volume (10).

ANTIDYSLIPIDEMIC ACTIVITY

Mishra et al (2014) investigated the antidyslipidemic potential of ethanolic extract of *Rheum emodi*. emodin 8-O- β -D-glucopyranoside, chrysophanol, chrysophanol 8-O- β -D-glucopyranoside and emodin were active ingredients and has considerable activity in triton-induced rats by decreasing lipid level in plasma. Emodin indicated considerable hypolipidemic potential in high fed diet model (7).

NEPHROPROTECTIVE ACTIVITY

This plant is used to treat kidney diseases. It has a nephroprotective activity. The nephroprotective activity of *Rheum emodi* against gentamicin, potassium dichromate, mercuric chloride and cadmium chloride induced nephrotoxicity in rats studied. Urea nitrogen and creatinine level showed that the water-soluble portion of *Rheum emodi* extract possesses

nephroprotective potential on proximal segments of tubules that may be due to the antioxidant effect of tannins. Water-insoluble fraction exhibited nephroprotective activity in cadmium chloride and mercuric chloride induced nephrotoxicity in rat models but this fraction enhanced the nephrotoxicity symptoms induced by gentamicin (27).

ANTI-INFLAMMATORY

The anti-inflammatory activity of petroleum ether extract of rhizomes of *Rheum emodi* has been reported. Chrysophanol was found to be the main constituents responsible for anti-inflammatory activity (28).

ANTI-OXIDANT ACTIVITY

Anti-oxidant activity of stilbenoids isolated from *Rheum emodi* has been reported (29).

CONTRAINDICATIONS

It is contraindicated in patients suffering from hyperuricemia, gouty arthritis, convulsion and gall bladder or renal stones. Oxalic acid is found in the rhizome of *R. Emodi* that combines with calcium forming the calcium oxalate crystals that may deposit in gall bladder or kidneys (6)

CONCLUSION

Medicinal potential of *Rheum emodi* is enormous and difficult to cover in a single article, despite the present review provided glimpses of *Rheum emodi* for performing an appraisal of this promising medicinal plant. Although various bioactive ingredients have been separated from *Rheum emodi*, still the information is in infancy, in term of its total reserve. Perhaps, future rigorous researches directed towards the investigation, and commercialization of

Rheum emodi bioactive ingredients can lead to the development of treatment for numerous ailments. Thus, it can also

prove the validity of the therapeutic use of *Rheum emodi* in traditional system of medicine.

REFERENCES

1. Aslam M, Dayal R, Javed K, Fahamiya N, Mujeeb M, Husain A. Pharmacognostical and phytochemical evaluation of *Rheum emodi* Wall. Current Pharma Research. 2012;2(2):471.
2. Rajkumar V, Guha G, Ashok Kumar R. Antioxidant and anti-cancer potentials of *Rheum emodi* rhizome extracts. Evidence-Based Complementary and Alternative Medicine. 2011. 121-128
3. Babu KS, Srinivas P, Praveen B, Kishore KH, Murty US, Rao JM. Antimicrobial constituents from the rhizomes of *Rheum emodi*. Phytochemistry. 2003;62(2):203-7.
4. Ibrahim M, Khaja MN, Aara A, Khan AA, Habeeb MA, Devi YP, et al. Hepatoprotective activity of *Sapindus mukorossi* and *Rheum emodi* extracts: in vitro and in vivo studies. World Journal of Gastroenterology: WJG. 2008;14(16):2566.
5. Ibrahim M, Khan AA, Tiwari SK, Habeeb MA, Khaja M, Habibullah C. Antimicrobial activity of *Sapindus mukorossi* and *Rheum emodi* extracts against *H. pylori*: In vitro and in vivo studies. World Journal of Gastroenterology: WJG. 2006;12(44):7136.
6. Rehman H, Begum W, Anjum F, Tabasum H. *Rheum emodi* (Rhubarb): A fascinating herb. Journal of Pharmacognosy and Phytochemistry. 2014;3(2).
7. Mishra SK, Tiwari S, Shrivastava A, Srivastava S, Boudh GK, Chourasia SK, et al. Antidyslipidemic effect and antioxidant activity of anthraquinone derivatives from *Rheum emodi* rhizomes in dyslipidemic rats. Journal of natural medicines. 2014;68(2):363-71.
8. Khan SA, Ahmad A, Khan MI, Yusuf M, Shahid M, Manzoor N, et al. Antimicrobial activity of wool yarn dyed with *Rheum emodi* L. (Indian Rhubarb). Dyes and Pigments. 2012;95(2):206-14.
9. Malik MA, Bhat SA, Fatima B, Ahmad SB, Siddiqui S, Shrivastava P. *Rheum emodi* as a valuable medicinal plant. Int J Gen Med Pharm. 2016;5:35-44.
10. Kaur A, Sharma R, Kumar S. Antiulcer activity of *Rheum emodi* growth factors. 2013;2:3.
11. Akhtar M, Amin M, Ahmad M, Alamgeer A. Hepatoprotective effect of *Rheum emodi* roots (Revandchini) and Akseer-e-Jigar against paracetamol-induced hepatotoxicity in rats. Ethnobotanical Leaflets. 2009;2009(2):3.
12. Kaur A, Kaur S, Kaur M, Mahajan A, Bose S. *Rheum emodi*: A review on pharmacology and phytochemistry. World J Pharm Res. 2015;4:1892-902.
13. Singh R, Tiwari T, Chaturvedi P. *Rheum emodi* Wall ex.

- Meissen (Indian Rhubarb): Highly endangered medicinal herb. Journal of Medicinal Plants. 2017;5(4):13-6.
14. Pandith SA, Hussain A, Bhat WW, Dhar N, Qazi AK, Rana S, et al. Evaluation of anthraquinones from Himalayan rhubarb (*Rheum emodi* Wall. ex Meissn.) as antiproliferative agents. South African Journal of Botany. 2014;95:1-8.
15. Radhika R, Krishnakumar I, Sudarsanam D. Antidiabetic activity of *Rheum emodi* in alloxan induced diabetic rats. Int J Pharm Sci Res. 2010;8:296-300.
16. Kim SM, Kang K, Jho EH, Jung YJ, Nho CW, Um BH, et al. Hepatoprotective effect of flavonoid glycosides from *Lespedeza cuneata* against oxidative stress induced by tertbutyl hydroperoxide. Phytotherapy Research. 2011;25(7):1011-7.
17. Pattanayak S, Nayak SS, Panda DP, Dinda SC, Shende V, Jadav A. Hepatoprotective activity of crude flavonoids extract of *Cajanus scarabaeoides* (L) in paracetamol intoxicated albino rats. Asian J Pharm Biol Res. 2011;1(1):22-7.
18. Wani PA, Nawchoo IA, Wafai B. The Role of Phenotypic Plasticity, Phenology, Breeding Behaviour and Pollination Systems in Conservation of *Rheum emodi* Wall. ex Meissn. (Polygonaceae)—A Threatened Medicinal Herb of North West Himalaya. The International Journal of Plant Reproductive Biology. 2009;1(2):179-89.
19. Sina I. Al Qanoon Fil Tib (Urdu trans. by Kantoori GH). Vol I & II New Delhi: Idara-e-Kiabus-Shifa. 2007;31:32.
20. NajmulGhani K. Lucknow: Munshi Naval Kishore Press. YNM. 61-78
21. Arvindekar A, More T, Payghan PV, Laddha K, Ghoshal N, Arvindekar A. Evaluation of anti-diabetic and alpha glucosidase inhibitory action of anthraquinones from *Rheum emodi*. Food & function. 2015;6(8):2693-700.
22. Hassan M, Malik S. Hepatoprotective Potential of '*Rheum Emodi* Wall' on Carbon Tetrachloride-Induced Hepatic Damage. Ann Pak Inst Med Sci. 2008;4(3):1525.
23. Zakaria Z, Rofiee M, Somchit M, Zuraini A, Sulaiman M, Teh LK, et al. Hepatoprotective activity of dried-and fermented-processed virgin coconut oil. Evidence-Based Complementary and Alternative Medicine. 2011;2011: 7-13
24. Harvey HE, Waring JM. Antifungal and other compounds isolated from the roots of New Zealand flax plants (The genus *Phormium*). Journal of natural products. 1987;50(4):767-.
25. Agarwal S, Singh SS, Verma S, Kumar S. Antifungal activity of anthraquinone derivatives from *Rheum emodi*. Journal of ethnopharmacology. 2000;72(1-2):43-6.
26. Rajkumar V, Guha G, Kumar RA. Apoptosis induction in MDA-MB-435S, Hep3B and PC-3 cell lines by *Rheum emodi* rhizome extracts. Asian Pac J Cancer Prev. 2011;12:1197-200.
27. Alam MA, Javed K, Jafri M. Effect of *Rheum emodi* (Revand Hindi) on renal functions in rats. Journal of ethnopharmacology. 2005;96(1-2):121-5.

28. Ahmad Z, Jafri M, Javed K. Quantitative evaluation of free and combined states of Rhein and Chrysophanol in Indian rhubarb by tlc: colourimetric method. Indian Drugs. 1998;35(2):75-8.
29. Chai Y-y, Wang F, Li Y-l, Liu K, Xu H. Antioxidant activities of stilbenoids from *Rheum emodi* Wall. Evidence-based Complementary and Alternative Medicine. 2012. 97-103

Table 1: Taxonomic classification and different names of *Rheum emodi*

Biological grouping	Names	Languages	Names
Kingdom	Plantae	English	Indian rhubarb (8)
Subkingdom	Tracheobionta	Unani	Ravandchini (9)
Division	Magnoliophyta	Ayurvedic	Gandhini Revatikka (6)
Class	Magnoliopsida	Arabic	Reward (10)
Family	Polygonaceae	Sanskrit	Revatchini Hindi Dolu (9)
Genus	Rheum	Persian	Ravandchini (11)
Species	Emodi	Kashmiri	Pumbehakh (12)
Binomial name	<i>Rheum emodi</i> Wall	French	Rhubarb de parse (13)

Table 2: Isolated compounds from rhizomes of *Rheum emodi*

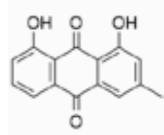
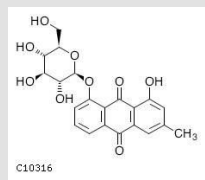
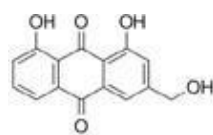
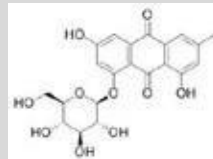
Code of compound	Molecular weight	Molecular formula	Characterized as	Structure
RE-1	254	C ₁₅ H ₁₀ O ₄	Chrysophanol	
RE-2	416	C ₂₁ H ₂₀ O ₉	chrysophanol 8-O-β-D-glucopyranoside	
RE-3	270	C ₁₅ H ₁₀ O ₅	Emodin	
RE-4	432	C ₂₁ H ₂₀ O ₁₀	Emodin 8-O-β-D-glucopyranoside	

Table 3: Pharmacological Activities of *Rheum emodi*

Body systems	Disorders	Treatment s
Musculoskeletal system	Inflammation, redness swelling Bruises Abscesses	Its oil is applied on the affected part (19) and also suggested for the management of abscess (20). Grapes water prepared with rhubarb is taken orally (19). Decoction of Asarum is taken with Rewandchini (6)
Gastrointestinal system	Indigestion Jaundice Diarrhea	Taken with Chebulic myrobalan or Aloe vera or alone. Use with lukewarm water or aniseeds (6) Decoction of Apium graveolens, Cichorium intybus, Capparis spinosa and Foeniculum vulgare root is taken with rewandchini (6). It is used with Gum of acacia and dried roses (19)
Nervous system	Paralysis, migraine and headache	Chebulic myrobalan, Aloe vera or Polyporus officinalis is taken with rewandchini (20)
Urogenital system	Menorrhagia Urine retention Oligomenorrhoea with Dysmenorrhoea	Rheum emodi is taken with Nardostachys jatamansi and Plantago major juice (6). Tribulus terrestris and seeds of Cucumis melo is taken along with rewandchini Rewandchini is used 2 days before menstruation and continue during menstruation for 3 days.
Skin	Melasma Skin marks and freckles	Powdered root of Rheum emodi with fresh milk is applied (20) Make a paste of Rheum emodi root with vinegar and applied on affected part externally (20)
Respiratory system	Haemoptysis Asthma and cough	In mouth crushed root is chewed for some time (6) Resins of Quince with crushed Rhubarb and make pills (20)