Int J Ayu Pharm Chem

REVIEW ARTICLE

www.ijapc.com

e-ISSN 2350-0204

A Review on Therapeutic Potential of Trivrita (Operculina turpethum Linn.)

Satyapal Singh[1*], Sangeeta[2], Sudharma. I. Kodituwakku[3], Rajendra Prasad[4], J. S. Tripathi[5] and N.P. Rai[6]

[1-6]Department of Kayachikitsa, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Abstract

Trivrita (*Operculina turpethum* Linn.) is a large perennial herb from family Convolvulaceae. Natural products are part and parcel of human society to combat a wide range of disorders from the dawn of civilization. There may be more than 2,500 herbs including *Trivrita* are used across India in various forms of herbal medicine. Traditional medicine is a major part of the cultural heritage of a society and it has developed in accordance with the lifestyle and cultural practices of the society. Principally the root bark of *Trivrita* is used in its different formulations. It is described under *Bhedaniya Mahakashaya* (*Dashemani*) by Charaka and included in *Adhobhagahar* and *Shyamadi* group by Sushruta. It is considered best among the drugs used to induce *Virechan* (therapeutic purgation), one of the procedures of *Ayurvedic Panchakarma* therapy. *Trivrita* contains various secondary metabolites including saponins, flavonoids, glycosides like turpethien and phenolics and it also contains some amount of essential oil, glucose and fructose. Various studies on *Operculina turpethum* Linn. validated its different pharmacological action like laxative action, hypoglycemic action, anti-dyslipidemic effect, ani-inflammatory effect, ulcer protective effect, anti-microbial effect, etc. The present review comprehensively incorporates the phytochemical, pharmacological and therapeutic importance of *Trivrita*.

Keywords

Trivrita, *Phyto-constituents*, *Phyto-pharmacological*, *Therapeutic potential*, *Laxative action*

Greentree Group

Received 02/06/16 Accepted 16/07/16 Published 10/09/16

INTRODUCTION

The plant based traditional medical systems continue to play an essential role in health care. Man has been using natural products for combating diseases since times immemorial. Natural products, including plants, animals and minerals have been the basis of treatment for human disease[1]. Approximately 85-90% of the world's population consumes traditional herbal medicines for their health care needs as per World Health Organization (WHO)[2-3].

Operculina turpethum Linn. is widely grown throughout India and it is occasionally cultivated in gardens as an ornament. It has been used as a folk medicine in many countries to treat a wide range of disorders. It is a large perennial twiner commonly known as Indian Jalap in English. It is native to Asia, Africa and Australia while is naturalized in West Indies. It is commonly found in Godavari, Deccan, and Carnatic to South Travancore and the banks of Cauvery or Kollidam. In Kerala, the plant is found in degraded forest areas and plains[4].

Acharya Charaka suggested *Trivrita* as the best *Madhya* or *Sukha Virechan* drug[5]. *Acharya* Sharangadhar included *Trivrita* in his *Rechan* group. The drug which causes liquefaction of *Pakva* (proper digested) and *Apakva* (improper digested) *Malas* or vitiated *Doshas* and eliminate them out of the body through the anal route is known as '*Rechan*'. e.g. *Trivrita*[6].

WHO considers phytotherapy in its health program because the herbal drugs are safe, cost effective and most significantly people have faith on herbal drugs[7]. Herbal medicine contains natural substances that can promote health and reduce illness. Now days Researchers have focused on plant research and a large body of evidence has been collected to show immense potential of medicinal plants used in various traditional systems of medicine and *Trivrita* is one of them[8].

Trivrita has been used as a therapeutic agent for the management of a wide range of disorders. It is one of the important drugs among purgative and the herbs supportive for therapeutic enema. It is one of the important constituents of paste used locally, for the management of different dermatological disorders. The root powder was also found to be useful for treating hematemesis, tuberculosis and herpes and fresh juice of leaves is found to be effective for treatment of corneal opacity and conjunctivitis[9].

PHYTO-PHARMACOLOGICAL PROPERTIES AND THERAPEUTIC USES

Trivrita and other plants are recognized for their ability to produce secondary metabolites. The secondary metabolites are naturally synthesized in almost all parts of the plant. Secondary metabolites exhibit many pharmacological activities like hypoglycemic action, immune-modulating property, antioxidant, antibacterial, antifungal action, etc[10].

Properties

Ayurvedic system of medicine described various properties of *Trivrita* which are as follows[11].

Guna : Laghu

Rasa : Tikta, Katu

Vipaka : Katu

Veerya : Ushna

Being an important *Virechan* drug, *Trivrita* have five important properties which plays a major role in the mechanism of action of *Trivrita* for induction of *Virechan* (therapeutic purgation). The properties are as follows[12].

1. *Ushna*
2. *Tikshna*
3. *Sukshma*
4. *Vyavayi*
5. *Vikasi*

Chemical composition

Trivrita contains various secondary metabolites including saponins, flavonoids, glycosides, phenolics and also contains some amount of essential oil, glucose and fructose[13]. The bark contains a glycosidic resin, which has the insoluble glycoside turpethein[14]. Ding et. al. isolated four new dammarane-type saponins, operculinosides A–D (1–4) from the aerial parts of *Operculina turpethum* Linn.[15].

Inside human biological system secondary metabolites play very crucial role in the treatment of various ailments. Steroid glycoside represents essential group of secondary metabolites which exhibits a broad spectrum of pharmacological profile. Veena Sharma and Manu Singh reported that, root of *Operculina turpethum* Linn. yields a pharmacologically important glycoside, Stigma-5,22 dien-3-O-b-D-Glucopyranoside which can be further utilizes in preparation of different therapeutic formulations[16].

Three glycosidic acids, turpethic acids A−C, and two intact resin glycosides, turpethosides A and B, having a common pentasaccharide moiety and 12-hydroxy fatty acid aglycones of different chain

lengths has also isolated from the aerial parts of *Trivrita*[17].

Various phytosterols have reported to possess cholesterol lowering effect. These sterols are believed to interfere with the esterification of cholesterol. It has been reported that these sterols usually bind with the intestinal mucosal cell and interfere with the flow of cholesteryl ester through an interaction with lipoprotein towards the blood vessels[18]. The phytosterol also reported to have anticancer[19] as well as immune modulating property[20-22].

Traditional uses in *Ayurvedic* system of medicine

Trivrita leads to the bio-purification of *Kapha-Pitta Dosha* and has considered best for purification of *Pitta Dosha*. It has used for the management of *Kapha-Pittaja* disorders, chronic abdominal distension, *Bibandha* (constipation), *Kamla* (jaundice), *Udar Roga* (abdominal disorders), *Vatarakta* (gout), *Amavata* (arthritis), *Kasa* (disorders having cough as predominant symptom), *Shwas* (disorders having dyspnoea as predominant symptom), *Arsha* (haemorrhoid) , *Shotha* (edema) , etc.[11]

Evidence based pharmacological properties and therapeutic uses

Operculina turpethum Linn. has reported to possess various pharmacological properties like purgative /laxative effect, hypoglycemic action, anti-dyslipidemic effect, anti-inflammatory effect, ulcer protective effect, anti-microbial effect, hepato-protective effect etc.

Laxative effect

Samuel et.al investigated the laxative effect of *Operculina turpethum* Linn. leaf extract in mice weighing 28-34 gm. The dried leaves of *Trivrita* were successively extracted with hexane, chloroform and 70% methanol using cold maceration. 200 mg/kg and 400 mg/kg of each extract were administered and castor oil was used as positive control. The treatment of the mice with the extracts and castor oil produced various degrees of wet feces. The chloroform and methanol extract produced a significant ($P < 0.05$) dose and time dependent increase in the percentage of wet feces in the treated groups when compared to the negative control group. It is also observed that there is significant ($P < 0.05$) dose dependent increase in the intestinal motility in the treated mice when compared to the negative control. The treatment of the mice with the extracts did not produce any significant ($P > 0.05$) change in the

intestinal content volume when compared to the negative control. Therefore, validate the potent laxative activity of *Trivrita* [31].

Anti-diabetic effect

A study reported the anti-diabetic effect of the methanolic extract of *Trivrita* stem (MEOTS) and methanolic extract of *Trivrita* root (MEOTR). The MEOTS and MEOTR were evaluated in the streptozotocin induced type 2 diabetic models. The MEOTS and MEOTR were administered in the dose 100 mg/kg to normal, glucose loaded and experimental diabetic rats for 21 days. The study shows significant ($p< 0.05$) reduction in fasting blood glucose levels observed in the normal rats at 3 h as well as in the treated diabetic animals at 21 days, thereby validates the anti-diabetic or hypoglycemic action of *Trivrita*[23].

Cardio-protective and anti-dyslipidemic effect

In a study Dr. Veena and Manu investigated the protective effect of ethanolic root extract on serum lipid profile in male albino mice intoxicated with N-Nitrosodimethylamine (NDMA). N-nitrosodimethylamine is a potent hepatotoxin and carcinogen and has been reported to be found in the chloraminated drinking water from treatment plants and distribution systems. Adult male albino mice, treated with NDMA at a concentration of 10 mg/kg body weight received root extract orally in doses of 300 and 400 mg/kg body weight at 5 h after the administration of NDMA. NDMA treated mice showed a significant decrease in the levels of low density lipoprotein (LDL) in the serum of mice received extract at a concentration 300mg/kg body weight, further, an increase in the level of high density lipoprotein (HDL) in serum of mice reported, who received extract at a concentration 400mg/kg body weight after intoxication with NDMA. It shows that administration of ethanolic extract at a dose of 300 mg/kg body weight significantly attenuated the alterations caused by the intoxication of NDMA when compared with the standard and restored the levels of triglycerides in the serum of mice[24].

Anti-inflammatory effect

Rajashekar M et al. evaluated the effect of oral root powder of *Trivrita* and its polyherbal formulation, *Avipattikar Churna* on rat paw edema in albino rats. Results validated that pretreatment with the root powder of *Trivrita* and *Avipattikara* Churna (100 mg/kg body weight) reduced the formalin induced edema volume to the

extent of 36.45% and 27.11%, respectively[25].

Anti-ulcer effect

An experimental study validated the concept of chronopharmacology and measures the influence of different six *Ritus* (seasons) on gastric secretions by *Trivrita* in pylorus ligated rats. The antiulcer effect of *Trivrita* given orally in a dose of 100 mg/kg was compared with reference drug lansoprazole 30mg/kg. The study spanned for all the six *Ritus* of the year i.e *Shishira, Vasant, Grishma, Varsha, Sharada* and *Hemanta Ritu*. Adult albino rats of either sex weighing between 180–220 g were used for study. Volume of HCl, pH, free acidity, total acidity and ulcer index were recorded as parameter for assessment in comparison with standard lansoprazole. The study indicated statistically significant difference by Dunnet-t test between standard and test. The acid secretion for different '*Ritus*' vary significantly and similarly the gastro protection of *Trivrita* and lansoprazole also vary over different seasons. The studies reveal management of hyperacidity and ulcers can be done more effectively with variation of doses in different seasons. Thus, validate a safe, cost effective and efficacious treatment by *Trivrita* with less or no unwanted effects[26].

Anti-microbial effect

In a study the Jahangir et. al. reported that ether and ethanol extracts from leaves of *Trivrita* showed potential antimicrobial properties against several human pathogenic bacteria with a minimum inhibitory concentration (MIC) ranged from 0.13-0.75 mg per ml. In general, ethanol extracts showed higher activity than petroleum ether extracts and produced inhibition zones ranging from 9 to 14 mm in diameter at a concentration of 5.0 mg per ml. The Minimum inhibitory concentration (MIC) values of active extracts were determined by the broth dilution method. Ethanol extracts had lower MIC values comparable with petroleum ether extract against the tested strains[27]. Some other studies also showed the anti-microbial activity of *Trivrita* against many human pathogenic bacteria[28-29].

Hepato-protective effect

A study validated the hepto-protective activity of the *Trivrita* root extract against N-nitrosodimethylamine induced toxic liver injury in rats[30].

CONCLUSION

Trivrita is an important medicinal plant, which has used effectively to treat various

disorders in *Ayurvedic* system of medicine since centuries. *Trivrita* possess various medicinal properties and hence can be used in the treatment of a wide range of disorders. It is also a good source of various biologically active phyto-constituents. These phyto-constituents can be used directly as therapeutic agents as well as starting materials for the synthesis of pharmacologically active compounds. The present review has focused on phytochemical, pharmacological and different therapeutic uses of *Trivrita*. This collective knowledge on *Trivrita* would motivate to researchers and may provide lead to further exploration of various pharmacological and phytochemical activities of *Trivrita*. The use of plants and plant products including *Trivrita* in medicines is getting popularized because the herbal medicines are cheap and cost effective and have higher safety margins with lesser or no side effects.

REFERENCES

1. Singh S, Tripathi JS, Rai NP. A Review of Pharmacodynamic Properties of 'Nishadi Vati'-A Herbomineral Ayurvedic Formulation. International Journal for Pharmaceutical Research Scholars (IJPRS), 2014; 3 (2): 849-868.
2. Raj Arun GR, Shailaja U, Prasanna N Rao, Ajayan S, Nivya P Thomas. Review on the contribution of Ura-Marunnu, a traditional baby care practice in southern India. The Pharma Innovation, 2014; 2(11):42-70.
3. Kimmatkar N, Thawani V, Hingorani L, Khiyani R. Efficacy and tolerability of Boswellia serrata extract in treatment of osteoarthritis of knee-a randomized double blind placebo controlled trial. Phytomed, 2003; 10:3-7.
4. Anju V Jalaj and P M Radhamany. pharmacognostic and phytochemical studies on Operculina turpethum (l.) silva manso stem. World Journal of Pharmacy and Pharmaceutical Sciences, 2015; 4(7): 1920-1927.
5. Singh Satyapal, Tripathi J.S., Rai N.P.. Critical Appraisal of Virechan Karma (Therapeutic Purgation) and it's Bio-Purificatory Potential. MEDHA (International Journal of Multidisciplinary Researches), 2015; 6 (1-4): 59-67.
6. Singh Satyapal, Rai N. P. A Review on Pharmacology of Virechan Drugs. Anukriti (An International Multidisciplinary Research Journal), 2013; 3(1): 182-186.
7. Waddar S, Gopi KBJ, Rao PN, Raj AGR, Waddar S. Standardization of Mulaka (Raphenus sativus Linn.) Kshara: an herbal alkaline preparation. Journal of Pharmacognosy and Phytochemistry, 2014; 3(1):108-110.
8. Singh Satyapal, Rai N.P.. Phytopharmacological Overview on 'Kushthaghna Mahakashaya'. World journal of pharmacy and pharmaceutical sciences, 2015, 4(1): 306-333.
9. Harun-or-Rashid, Gafur MA, Golam S, Aziz AR. Antibacterial and Cytotoxic Activities of Extracts and Isolated Compounds of Ipomoea turpethum, Pakistan Journal of Biological Sciences, 2002; 5(5): 597-599.
10. Chanda S, Dudhatra S, Kaneria M. Antioxidative and Antibacterial effects of seeds and fruit rind of nutraceutical plants belonging to the fabaceae family. Food Function, 2010; 1(3): 308-315.

11. Sharma P.V., dravyaguna vigyan, reprint, Chaukhambha bharti academy, Varanasi, 2003, 420.

12. Singh Satyapal, Byadgi P S, Rai N P. Clinical evaluation of virechan therapy and haridradi vati and oil for the management of kitibh kushtha (psoriasis). Int. J. Res. Ayurveda Pharm, 2013, 4(2):207-211.

13. Sharma V., Singh M. Operculina turpethum as a panoramic herbal medicine. International Journal of Pharmaceutical Sciences and Research, 2012; 3(1): 01-05.

14. Sharma V., Singh M. Alterations induced by N- Nitrosodimethylamine and ethanolic root extract of Operculina turpethum in serum lipid profile of male albino mice. Asian J Pharm Clin Res., 2012;(5)3:69-73.

15. Ding W., Zeng F., Xu L., Chen Y., Wang Y., Wei X. Bioactive Dammarane-Type Saponins from Operculina turpethum. J. Nat. Prod., 2011; 74: 1868–1874.

16. Sharma Veena, Singh Manu. Isolation and Characterization of Stigma-5, 22dien-3-O-b-D-Glucopyranoside from the ethanolic root extract of Operculina turpethum. International Journal of Advanced Research, 2013; 1(8): 303-312.

17. Wenbing Ding, Zi-Hua Jiang, Ping Wu, Liangxiong Xu, Xiaoyi Wei. Resin glycosides from the aerial parts of Operculina turpethum. Phytochemistry, 2012; 81:165-174.

18. Jong A., Plat J., Mensink R.P. Metabolic effects of plant sterols and stanols. J Nutr Biochem, 2003;14(7): 362–369.

19. Von H.R.L., Fink C.S., Awad A.B. β-Sitosterol activates the sphingomyelin cycle and induces apoptosis in LNCaP human prostate cancer cells. Nutr Cancer, 1998; 32: 8–12.

20. Pegel K.H. The importance of sitosterol and sitosterolin in human and animal nutrition. S. Afr. J. Sci., 1997; 93:263–268,

21. Moreau R.A., Whitaker B.D., Hicks K.B. Phytosterols, phytostanols, and their conjugates in foods: Structural diversity, quantitative analysis, and health-promoting uses. Prog. Lipid Res., 2002; 41:457–500.

22. Bouic P.J. The role of phytosterols and phytosterolins in immune modulation: A review of the past 10 years. Curr. Opin. Clin. Nutr. Metab. Care, 2001; 4:471–475.

23. Shankaraiah Pulipaka, Srinivasa Reddy Challa, Pingili Ravindra Babu. Comparative antidiabetic activity of methanolic extract of Operculina turpethum stem and root against healthy and

streptozotocin induced diabetic rats. International Current Pharmaceutical Journal, 2012; 1(9): 272-278.

24. Sharma Veena, Singh Manu. alterations induced by n-nitrosodimethylamine and ethanolic root extract of operculina turpethum in serum lipid profile of male albino mice. Asian J Pharm Clin Res, 2012; 5 (3): 69-73.

25. Rajashekar M. Bhande, Laakshmayya, Pramod Kumar, Nitin K. Mahurkar, S. Ramachandra Setty. Pharmacological Screening of Root of Operculina turpethum and its Formulations. Acta Pharmaceutica Sciencia, 2006; 48: 11-17.

26. Mahurkar Nitin, Malpani A. Arati, S. Inamdar Shivkumar, ulhasan S.M. Sayeed, Madri S Girishkumar. Chronopharmacological Influence of Operculina turpethum in Pylorus Ligated Albino rats. RGUHS J Pharm Sci, 2012; 2 (4): 73-79.

27. Alam M. Jahangir, Alam Iftekhar, Sharmin Shamima Akhtar, Rahman M. Mizanur, Anisuzzaman M., Alam Mohammad Firoz. Micropropagation and antimicrobial activity of Operculina turpethum (syn. Ipomoea turpethum), an endangered medicinal plant. POJ, 2010; 3(2):40-46.

28. Trakulsomboon S, Kummalue T, Jiratchariyakul W. Antibacterial Activities of Four Thai Medicinal Plants. J Med Assoc Thai, 2006; 89 (9): 1466-71.

29. Abdelsalam H, Bogdadi A , Kokoska L , Havlik J , Kloucek P, Rada V, Vorisek K (2007) In vitro antimicrobial activity of some libyan medicinal plant extracts. Pharmaceut Biol, 2007; 45:386-391.

30. Ahmad Riaz, Ahmed Sarfaraz, Khan Nizam Uddin, Hasnain Absar-ul. Operculina turpethum Attenuates N-nitrosodimethylamine induced toxic liver injury and Clastogenicity in rats. Chemico Biological Interactions, 2009; 181(2): 145-153.

31. Samuel O. Onoja, Gideon K. Madubuike, Maxwell I. Ezeja, Chidiebere Chukwu. Investigation of the Laxative Activity of Operculina turpethum Extract in Mice. International Journal of Pharmaceutical and Clinical Research, 2015; 7(4): 275-279.