



PHYTOCHEMICAL AND PHARMACOLOGICAL EVALUATION OF TRIPHALA: A REVIEW

¹Gull Mohd Mir* and Bilal Ahmad Dar

¹Department of Chemistry, Government Degree College for Women's Anantnag (J&K).

²Department of Chemistry, Sadhu Vaswani College Bairagarh Bhopal.

* Corresponding Author: Gull Mohd Mir

Department of Chemistry, Government Degree College for Women's Anantnag (J&K).

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ABSTRACT

Triphala a polyherbal formulation is well known from Ayurveda. It is a Rasayana Drug used in Indian System of Medicine (ISM).^[1] A mixture of three fruits which is composed of dried fruits of *Embllica officinalis* Gaertn (Euphorbiaceae), *Terminalia bellerica* Linn (Combretaceae) and *Terminalia chebula* (Combretaceae) with equal proportions of (1:1:1) as described in Ayurvedic Formulary of India.^[2] Triphala is one of the best Ayurvedic curative herbal formulations prescribed by most health care practitioners. It is moderate for people of all ages from children to seniors.^[3] In Ayurvedic system Triphala is termed as a tridoshic rasayana and to have balancing and rejuvenating effects on the three constitutional elements that govern human life (Vata, Pitta and Kapha).^[4-5] Infectious or communicable diseases are the leading cause of death worldwide and the numbers of deaths from these infectious diseases are increasing day by day. Among all of infectious disorders pneumonia, diarrhoea, tuberculosis and malaria have been the leading causes of death.^[6] According to recent literature 50,000 men, women and children are dying every day due to these diseases.^[7] This translates into approximately 50,000 preventable deaths per day.^[8] If present trends continue, 4.4 million people will die upto 2030 with these infectious diseases. Microbes that cause illness are also known as pathogens. The most common pathogens are bacteria and viruses, though a number of other microorganisms, including some kinds of fungi and protozoa, also cause disease. An infectious disease is termed communicable if it is easily transmitted from one person to another. There is also strong evidence that microbes may contribute to many non-infectious chronic diseases such as some forms of cancer and coronary heart disease.^[9] In the human host, a microorganisms causes disease by either disrupting a vital body process or stimulating the immune system to mount a defensive reaction. An immune response against a pathogen, which can include high fever, inflammation and other damaging symptoms, may be more destructive than the direct damage caused by the microorganism.^[10]

KEYWORDS: Infectious disorders, pneumonia, diarrhoea, tuberculosis and malaria.

Phytochemical Constituents of Triphala

The most common chemical compounds present in this drug are Tannin, Gallic acid, Chebulagic acid, Ellagic acid, Phenols and Glycosides. Phenolic acids, flavonoids and tannins are the most commonly found polyphenolic compounds in plant extracts. Total Phenolic content in Triphala by using spectrophotometric methods has been evaluated and the phytochemical investigation showed that Triphala is rich in phenols/polyphenols (38.3%) and tannins (35.13%), while flavonoids were found to be absent. HPLC studies reveal the presence of four phenolics gallic acid (0.026% w/w), tannic acid (0.024% w/w), syringic acid (0.016% w/w) and epicatechin (0.013% w/w) along with ascorbic acid (0.036% w/w) in triphala. *E.officinalis* contained ascorbic acid (0.026%), gallic acid (0.081%), *T.bellirica* contained gallic acid (0.005% w/w), tannic acid (0.004% w/w) and ascorbic acid (0.023%), while *T.chebula* contained gallic acid

(0.024% w/w), tannic acid (0.011% w/w), syringic acid (0.009% w/w) and epicatechin (0.0060% w/w) together with ascorbic acid (0.02%). Triphala contains numerous other phenols.^[11] HPLC analysis (column, C₁₈PCX₅₀₀; mobile phase, aqueous acetonitrile (10%)–HCl (0.05 M)–KCl (0.1M); detection, absorbance at 260 nm) showed that Triphala contains 73.5 mg Gallic acid per gram of Triphala, which was found to increase to 150.5 mg/g upon acid hydrolysis. Tannins are naturally occurring, high molecular weight plant polyphenols. They are usually subdivided into two groups, hydrolysable tannins and condensed tannins. The total tannin content present in Triphala was measured using a colorimetric Folin–Denis method. The measurements were compared with standard tannic acid sample and results expressed in terms of % tannic acid equivalents. The tannin content in Triphala was found to be 35.3%. Analysis of total flavonoid content in Triphala has been

done using colorimetric method and quercetin as standard flavonoid. The results showed that Triphala did not contain any significant amount of flavonoids.^[12]

Pharmacological Importance of Triphala

Oral Hygiene

Professor Sharma (2005) reported that Ayurveda recognizes oral cavity as one of the nine openings of physical body and also stressed that these openings are full of impurities with their secretions throughout day and night, hence *Ayurveda* suggests cleaning these openings frequently and regularly. Oral cavity being the chief entrance of the main gateway, as it were to the body, it goes without saying that it always should be kept healthy from the attack of enemies of health. Further the process of digestion begins in the mouth itself; hence one must keep the oral cavity clean and fresh. *Ayurveda* described following procedures under oral Hygiene-Brushing the teeth (*Danta dhavana*) Tongue scraping (*Jihwanirlekhana*) Gargling (*Gandusha & Kavala*) Chewing betel (*Tambula sevana*) and cleaning the face (*Mukha Prakshalana*).^[13]

Antidiabetic Activity

Sabu et al., (2002) reported that the oral administration of Triphala extract (100 mg/kg body weight) has reduced the blood sugar level in normal and in alloxan (120 mg/kg) diabetic rats significantly within 4 hours and continued daily administration of the drug produced a sustained antidiabetic effect.^[14] Nitinshigare reported that the Diabetes mellitus is an important human ailment afflicting many from various walks of life in different countries. Increased *Kapha Dosha* and adipose tissue *Medodhatu* are the important factors in it. *Triphala* powder along with honey should more beneficial result than *Triphala* powder along with lukewarm water in the Diabetic patients. In this research study one group of 30 patients treated with *Triphala* with honey and second group of 30 patients treated with *Triphala* with lukewarm water as *Anupana* by 5gm dose of *Triphala* for 90 days.^[15]

Antibacterial Activity

Srikumar (2007) worked on the antibacterial activities of aqueous and ethanol extracts of Triphala and its individual components were tested against certain bacterial isolates (*Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Shigella sonnei*, *S. flexneri*, *Staphylococcus aureus*, *Vibrio cholerae*, *Salmonella paratyphi-B*, *Escherichia coli*, *Enterococcus faecalis*, *Salmonella typhi*) obtained from HIV infected patients using Kirby-Bauer's disk diffusion and minimum inhibitory concentration (MIC) methods. Most of the bacterial isolates were inhibited by the ethanol and aqueous extracts of *T. chebula* followed by *T. bellirica* and *E. officinalis* by both disk diffusion and MIC methods.^[16] Bajaj et al., (2011) reported that Triphala controls dental plaque, gingival inflammation and microbial growth caused by *Streptococcus mutans* and *Lactobacillus*. Triphala controls plaque from base line and its activity is

comparable to commonly available mouth wash Chlorhexidine.^[17]

Eye Treatment

Mahajan et al., (2011) described that Triphala is also widely taken for all eye diseases including the treatment of conjunctivitis, progressive Myopia, the early stages of glaucoma and cataracts. *Triphalaghrita* at a dose of 1080 mg gives protection against delaying the onset and progression of cataract. The anti-cataract effect may be attributed to antioxidant activity of Gallic acid, ellagic acid and ascorbic acid.^[18]

Triphala in Arthritis

Gowda et al., (2012) reported the efficacy of Triphala on monosodium urate crystals-induced inflammation for gouty arthritis was compared with non-steroidal anti-inflammatory drug indomethacin. Triphala treatment inhibited paw volume, levels of lysosomal enzymes, LPO and inflammatory mediator tumor necrosis factor- α , β -glucuronidase, and lactate dehydrogenase level were reduced. Triphala exerted a strong anti-inflammatory effect against gouty arthritis. Triphala (1g/kg/body weight) was evaluated for its antiarthritic effect against indomethacin (3 mg/kg/body weight) in arthritis-induced rats by Freund's adjuvant (0.1ml). Levels of lysosomal enzymes, tissue marker enzymes, glycoproteins, and paw thickness increased in arthritis-induced animals. The physical, biochemical changes observed in arthritic animals were altered significantly to near normal conditions after oral administration of Triphala.^[19]

Antimicrobial and Antioxidant Effect of Triphala

Prakash et al., (2014) reported that an antimicrobial and antioxidant effect of Triphala has been proven *in vitro* as it has been shown to inhibit *S. mutans* at concentrations as low as 50 μ g/ml. This antiplaque effect probably may be due to the tannic acid in Triphala, which is adsorbed well to the groups on the surface of the bacterial cells, which result in protein denaturation and ultimately to bacterial cell death. The strong antioxidant activity of Triphala may be attributed to *T. bellirica*, which is the most active antioxidant followed by *E. officinalis* and *T. chebula*. The major ingredients of *T. bellirica* are ellagic and gallic-acid; *E. officinalis* has several gallic acid derivatives including epigallocatechin gallate and in *T. chebula*; gallic acid is the major ingredient. The presence of these active ingredients of phenolic nature may be responsible to scavenge the free radicals.^[20]

Triphala as a Mouth Rinse

Tandon et al., (2010) concluded that the ayurvedic drugs have been used since ancient times. Oral rinses made from these are used in periodontal therapy. Triphala is one of these with a wide spectrum of activity. According to the Sushruta Samhita, Triphala can be used as a gargling agent in dental diseases. 0.6% Triphala mouthwash has shown to have significant anticaries activity, which is comparable to that of chlorhexidine without possessing disadvantages as staining of teeth and

at much less cost although there was no evidence of remineralisation of tooth structure.^[21]

Analgesic, Antipyretic and Ulcerogenic Activities

Deraedt et al., (1976) reported the analgesic, antipyretic and ulcerogenic activities of Triphala (500- 1000mg / Kg Body weight) were compared with the non steroidal anti-inflammatory drug Indomethacin(10 mg/ kg Body weight) on the experimental models in mice and it was found that Triphala at both the dose levels produced excellent analgesic and antipyretic effect, without any gastric damage.^[22]

Anticancer and Antistress Effect

Dhana lakshmi et al., (2007) reported that the Triphala supplementation has a protective effect against stress. Triphala administration for 48 days (1g/kg/animal body weight) prevents cold stress induced behavioral and biochemical abnormalities like increase in immobilization, with decrease in rearing, grooming and ambulation behavior, significant increase in lipid peroxidation (LPO) and corticosterone levels.^[23] Srikumar et al., (2006) concluded that Triphala prevents noise-stress induced changes in antioxidant and cell mediated immune response in rats. Changes induced by noise stress at 100 dB for 4hour/d/15 days were controlled by Triphala at 1g/Kg/body weight/48 days.^[24] Kaur et al., (2002) reported that the anticancer effects of Triphala at equal proportions of each plant extracts have been investigated by a few studies. The aqueous extract of Triphala was toxic both on human breast cancer cell line (MCF7) and a transplantable mouse thymic lymphoma (barcl-95).^[25]

Action on Human Breast Cancer Cells

Sandhya et al., (2006) reported the cytotoxic effects of aqueous extract of Triphala have also been investigated on human breast cancer cell line (MCF/7) and a transplantable mouse thymic lymphoma (barcl/95) which suggests that Triphala possesses the ability to induce cytotoxicity in tumor cells but spares the normal cells. The differential effect of Triphala on normal and tumor cells seems to be related to its ability to evoke differential response in intracellular ROS generation.^[26]

CONCLUSIONS

Nowadays, due to extensive use of antibiotics and vast majority of synthetic drugs, many multidrug resistant strains are developing specially in hospital environment. To overcome drug resistance and to avoid side effects associated with the commonly available antibiotics, there is need of an alternative treatment method to cure such infections by use of traditional medicinal herbs like TB (*T. bellerica*), TC (*T. chebulla*) and EO (*E. officinalis*) which are potent antibacterial agents, clinically safer, economically cheaper and affordable. Triphala, a well known ayurvedic formulation, exhibits antioxidant activity and radio protection ability under in vitro conditions. The polyphenolic content in triphala confirm that the antioxidant and radioprotecting ability of triphala

arises from the polyphenols, which reduce oxidative stress by converting the reactive oxygen free radicals to non-reactive products. The studies are of great significance as the demand for herbal products as antioxidants and radio protectors is increasing constantly. Present review builds a foundation for further in vitro and in vivo studies to understand the mechanism of antimicrobial action of Triphala and its constituents which may help in developing better therapeutic agents and healthy products.

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