

Triphala: Its pharmacological values and new perspectives

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Abstract

Medicinal plants, with tremendous elementary and therapeutic importance, are the gift to humanity. Triphala is widely used in the traditional Indian system of medicine. It's an antioxidant-rich polyherbal formulation and possesses diverse beneficial properties. It's necessary to corroborate the consistency of blending or combining in attribute balance. As per Ayurvedic Formulary of India (AFI) it's prepared by combining a 1:1:1 mixing of ground dry fruits, called as myrobalans. It shows immune modulatory properties and helps in improving the body's weaponry. Recent studies suggest that triphala possesses anti-mutagenic, radio protecting and antioxidant activity and beneficial in diseases conditions. However, serious efforts are required in systemic research to spot, isolate and evaluate the chemical constituents for nutritional and therapeutic potentials.

Keywords: Triphala; Polyherbal; Antioxidant; Pharmacological activities

1. Introduction

Triphala is a drug widely utilized in many disorders because of its various pharmacological activities. It consists of the three myrobalans, *Terminalia chebula* Retz. (Haritaki), *Terminalia bellerica* Roxb. (Bibhitaki) and *Emblica officinalis* Gaertn. (Amalaki) and is one in all the foremost commonly used Ayurvedic preparations [1]. The ancient Ayurvedic texts describe triphala as a Tridoshic Rasayana, a therapeutic agent with balancing and rejuvenating effects on the three humours or constitutional elements in Ayurveda which are vata, pitta and kapha. One among the key ingredients of triphala is Amalaki [2]. *Terminalia chebula* Retz and *Terminalia bellerica* Roxb have a warm energy, while *Emblica officinalis* Gaertn. Iscool in nature. Triphala, is a balanced mixture of all the three which make it useful as an internal cleansing, detoxifying formula. It's a vital Rasayana and good purgative in Ayurvedic medicine [3].

1.1 Haritaki (*Terminalia chebula*, Family-Combretaceae)

Terminalia chebula Retz. (Combretaceae) consists of numerous phytoconstituents such as polyphenols, terpenes, anthocyanins, flavonoids, alkaloids, and glycosides. Due to the indiscriminate use of drugs, their costs, adverse effects, and interactions, herbal medicines can be an advisable alternative to treat diseases for they are easily available at comparatively low costs, and have fewer drug interactions [4].

1.2 Vibhitaki (*Terminalia bellirica* Roxb. Family: Combretaceae)

Dried ripe fruit of *Terminalia bellirica* Roxb. (Combretaceae) has traditionally been used in the treatment of diarrhoea, cough, and hoarseness of voice, eye diseases and scorpion-sting and as a hair tonic. A decoction of the fruit is used for

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treating cough and pulp of the fruit is useful in treating dysenteric-diarrhoea, dropsy, piles and leprosy [5]. Fruit and fruit extracts of *T. bellirica* have shown numerous pharmacological activities, including antidiabetic, analgesic, antiulcer, antifungal, antibacterial and anti-hypertensive activities [6].

1.3 Amalaki (*Emblica officinalis* Gaertn. Family–Euphorbiaceae)

Emblica officinalis Gaertn. (Family–Euphorbiaceae) also known as *Phyllanthus emblica*. In India, Amla trees are found throughout the forests of tropical area growing up to 4500 ft on hills. Amla is rich in fiber, carbohydrate, iron and is reported as the richest source of vitamin [7]. The fruit is also used in a combination form known as *E. officinalis* contains tannins, flavonoids, phenolic compounds, saponins, terpenoids, ascorbic acids, carbohydrates and many other constituents [8]. Supplements of fresh amla fruit is very useful to individuals suffering from anemia.

2. Chemical constituents

Triphala is found to be a rich source of vitamin C, gallic acid, ellagic acid, chebulinic acid, bellericanin, β -sitosterol, ascorbic acid and flavonoids [9]. Spectroscopic techniques including mass spectroscopy, nuclear magnetic resonance and Infrared spectroscopy shows that triphala contains gallic acid as the major component [10]. Triphala also contains about 20% tannins of both condensed and hydrolysable type. Other constituents identified include lipids, sitosterol, saponins, cardiac glycoside and various carbohydrates [11].

3. Traditional uses of triphala

In Ayurveda, triphala is used for gastric disorders such as digestive upset, poor assimilation of food, colon cleansing, and constipation. It is a good tonic for the gastrointestinal tract and colon. It is also used as a remedy for the treatment of cardiovascular disorders, high blood pressure, serum cholesterol reduction, ophthalmic problems, liver dysfunction, inflammation and complications of the large intestine [12]. It also act as blood purifier, to improve the mental faculties and is reported to possess 'anti-inflammatory, analgesic, antiarthritic, hypoglycemic and anti-aging properties [13].

4. Pharmacological activities

Triphala, the antioxidant rich herbal formulation is an important medicine of the Rasayana group promotes health, immunity and longevity and is frequently used to treat chronic ulcers. The powder of triphala is a promising anti-inflammatory and anti arthritic drug. It is a potent therapeutic agent for scavenging of nitric oxide, and is also commonly prescribed for symptoms of inflammation, heat, infection, obesity, anemia, fatigue, Candida, poor digestion assimilation, tuberculosis, pneumonia and AIDS.

5. Pharmacology and clinical studies: Reported activities of triphala as 1:1:1 ratio

5.1 Antihyperlipidemic effect of Triphala

An increase in the total cholesterol, LDL, VLDL and FFA were found in rats fed with a diet consisting of 4% Cholesterol, 1% cholic acid and egg yolk for forty eight days. Triphala when administered at a dose of 1g/kg body weight daily for forty eight days in these hypercholesteremic rats caused significant reduction in total cholesterol, LDL, VLDL and FFA [14].

5.2 Hepatoprotective effect

As per the information available in Ayurvedic literature, triphala may be used for the treatment of liver diseases. An *In vitro* study to conducted in which the hepatoprotective activity of methanolic extracts of Triphala (T), Triphala with honey (TM), Triphala with Pippali (TP) and Triphala with Yashtimadhu (TY) against acetaminophen induced toxicity using HepG2 cell line by MTT (3-(4, 5-dimethylthiazolyl)-2)-2, 5-diphenyltetrazolium bromide) assays. The study revealed the hepatoprotective activity of T, TM, TP, and TY by *In vitro* analysis on HepG2 cells against acetaminophen induced toxicity which was proven by MTT assay and flow cytometry and the results validate that Ayurveda combination T has more hepatoprotective property; in the increasing order TY<TP<TM< T [15].

5.3 Triphala against stress

Triphala is capable of fighting non-specific stress. Triphala significantly prevents cold-stress induced oxidative stress, measured by Lipid peroxidation (LPO), enzymatic SOD (SOD), catalase (CAT) non-enzymatic (vitamin C) antioxidation

status etc. Administration of triphala 1g/kg/body weight for 48 days prevents cold stress induced oxidation stress and elevation in LPO and corticosterone levels. Stress has been reduced by the supplementation of triphala. Behavioral and biochemical abnormalities like increase in immobilization, with increase in rearing, grooming and ambulation behavior, prevents noise-stress induced changes in antioxidant and cell mediated response in rats by cold stress [16].

5.4 Immunomodulatory effect

Study by Sreekumar et al. have shown that administration of triphala enhanced the phagocytosis, phagocytic index, antioxidant activities and decreased corticosterone levels in animals exposed to noise stress [17].

5.5 Anti-obesity activities of Triphala

In mice an Anti-obesity study which evaluated the herbal formulation triphala showed that the body weight was found to be reduced when compared with the control animals [18]. Due to easy availability and its anti-obesity property Gallic acid is a phenolic compound of triphala which is selected as a bioactive marker in various studies [19].

5.6 Anti-inflammatory and anti-arthritic effects

Rasool et al. evaluated the anti-arthritic effect of triphala. The physical and biochemical changes observed in arthritic animals were reversed to near normal conditions after administration of triphala orally at a dose of 1 g/kg/bw. Monosodium urate crystal-induced inflammation in mice was significantly altered by triphala treatment [18].

5.7 Analgesic, antipyretic and ulcerogenic activities

It was found that triphala produced excellent analgesic and antipyretic effect without any gastric damage when administered in mice at a dose of 500/1000 mg/kg bw. The effects were found comparable to that of the standard non-steroidal anti-inflammatory drug Indomethacin (10 mg/kgbw) [20].

5.8 Anticancer Activity

The use of triphala in diet has been shown to significantly reduce the benzopyrene induced stomach papillomagenesis in mice. It was observed that the concomitant use of multiple agents seemed to have a high degree of chemoprevention potential. The cytotoxic effects of aqueous extract of triphala were investigated using human breast cancer cell line (MCF/7) and a transplantable mouse thymic lymphoma (barcl/95) suggests that triphala induces cytotoxicity in tumor cells but spares the normal cells [21]. The human pancreatic cancerous cells, Capan-2 cells when exposed to triphala for 24 hours caused a remarkable decrease in cell survival and induced apoptosis. Triphala failed to induce apoptosis in normal human pancreatic ductal epithelial cells [22].

5.9 Antimicrobial activity

Srikumar et al. confirmed the antibacterial activities of aqueous and ethanol extracts of triphala and its individual components against *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Shigella sonnei*, *Shigella flexneri*, *Staphylococcus aureus*, *Vibrio cholerae*, *Salmonella paratyphi-B*, *Escherichia coli*, *Enterococcus faecalis* and *Salmonella typhi* isolated from human immune deficiency virus (HIV) infected patients [23].

5.10 Antidiabetic activity

Diabetes mellitus is an important human ailment afflicting many from various parts of life indifferent countries. Increased Kapha, Dosha and adipose tissue Medodhatu are the important factors in it. Triphala extract in dose of 100 mg /kg administered orally showed reduction the blood sugar level in normal and alloxan induced diabetic rat significantly within 4 hours and continued daily administration of the drug produced an effective anti-diabetic effect [24].

5.11 Wound healing activity

Reduction of matrix metalloproteinase expression observed in the treated group by gelatin zymography confirms that topical application of triphala ointment on infected wound not only reduces the risk of infection but also improved the healing [25]. A collagen sponge was prepared by incorporating triphala into it and was evaluated for its healing potential on infected dermal wound in albino rats. Triphala incorporated collagen sponge was found to increase the thermal stability, water uptake capability, produce faster wound closure, improved regeneration of tissue, increased collagen content at the wound site, and supporting histopathological parameters related to wound healing [26].

5.12 Clinical study of Triphala

Triphala clinically used for a long time for its effect on bowel movement and wellbeing. The therapeutic efficacy of triphala was evaluated on constipated bowel habit and wellbeing. No toxicity or adverse drug reactions were observed in the patients [27].

5.13 Anticataract activity

Triphala offers protection against cataract at a dose of 1080mg and provides protection against delaying the onset and progression of cataract. The activity may be due to the presence of antioxidant activity of gallic acid, ellagic acid and ascorbic acid present in triphala extract [28].

5.14 Antiplatelet activity

The chemical analysis of triphala reported the presence of tannic acid, chebulic acid and flavanoids. The presence of tannins in triphala during the early stage of plaque formation could effectively reduce the number of bacteria available for binding to the tooth surface through aggregate formation which increase their physical removal from the oral cavity. Also the effective inhibition of glucosyl transferase activity and reduced bacterial adhesion to hydroxyapatite in the presence of tannin extract suggests antiplatelet activity [28].

5.15 Antifungal activity

Triphala is found to possess antifungal activity against the dermatophytic fungal species and is effective in controlling the growth of pathogenic fungi. The aqueous extract of Triphala is also found have good antifungal activity against *Aspergillus* species, *Candida* species, *Trichophyton* species and *Torulopsis glabrata*. *Terminalia bellerica* and *Terminalia chebula*, which are the two ingredients of triphala is reported to have antifungal activity. It can be used in fungal infections of oral cavity [29,30].

5.16 Antiviral activity

Triphala and its contents are reported to possess antiviral activity. Ingredients of triphala showed significant inhibitory activity at lowest IC50 values against human immunodeficiency virus-1 reverse transcriptase and it also protect against damage caused by influenza A virus. Animal studies on mice has shown that *Terminalia chebula*, one of the ingredients of triphala inhibit replication of human cytomegalovirus (CMV) and murine CMV (MCMV) in MCMV infection models of immunosuppressed mice [29,30].

5.17 Anticollagenase activity

Triphala formulation is found to inhibit the collagenase enzyme activity in a dose-dependent manner. Each of the ingredients present in triphala causes significant and reproducible inhibition of collagenase. One of the components of triphala, *Terminalia chebula*, is the most potent collagenase type 2 inhibitor. Complete inhibition of collagenase can be caused by water extracts of triphala decoction (0.15 mg/ml) [30].

5.18 Laxative activity

Revathi S et al., evaluated the laxative activity of the methanolic extract of triphala on Albino Wistar rats and concluded that the triphala extract has significant positive effect on constipated animals. The study has shown that the triphala extract has the ability to increase the bowel movement in constipation condition induced by loperamide. Administration of the extract increased the faecal output and increasing the amount of extract increased the bowel movements in rats which in turn increased the total faecal output [31].

5.19 Radioprotective activity

Researches has shown that Triphala is effective in prevention of mutagenesis induced by both chemical- and radiation induced damage. In vitro studies reported that triphala eliminated reactive oxygen species in HeLa cells exposed to ionizing X-radiation or bleomycin, both of which generate DNA strand breaks through the generation of reactive oxygen species. It is also found to inhibit radiation-induced lipid peroxidation in rat liver microsomes and found to possess free radical scavenging activity which may be due to the presence of high levels of phenolic compounds such as gallic acid present in triphala [32].

5.20 Anti-aging activity

In vitro studies has shown that triphala extract possess highly protective anti-aging effects on human skin cells such as increasing collagen and elastin, increasing cellular antioxidants, and decreasing hyperpigmentation by affecting gene expression of human skin cells, stimulating collagen-1 and elastin-synthesizing genes and antioxidant genes which are responsible for the cellular antioxidant, SOD-2. It also exhibits significant free radical scavenging activity on hydrogen peroxide induced cell damage and senescence [32].

6. Conclusion

All the studies effects may be due to the proportionate increase in the levels of *T.bellerica* Linn., *T.chebula* Retz. and *E.officinalis* Gaertn. in the triphala. Both *T.bellerica* and *E.officinalis* are rasayana (rejuvenator) drugs with powerful antioxidant and free radical scavenging activity. The 1:2:4 formulation of triphala contain a higher proportion of antioxidants which would be responsible for its significant effect on hyperlipidemia compared to triphala1:1:1formulation.

Compliance with ethical standards

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Disclosure of conflict of interest

All authors declare there is no conflict of interest in this paper.

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