



REVIEW: TRIPHALA AS A POLY MEDICINAL HERB

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ABSTRACT

Now day naturally occurring medicine were increasing in its important over synthetic medicine because lack of adverse effects. *Triphala* one of the widely naturally occurring with tremendous medicinal application ayurvedic medicine. *Triphala* was consisting of dried fruits of the plant species of *Embllica Officinalis* (*Amalaki*), *Terminalia Bellerica* and *Terminalia Chebula*. Active phytoconstituent presents are gallic acid, tannic acid, syringic acid, epicatechin, ascorbic acid, chebulinic acid having antimicrobial, anticaring, wound healing, anticancer, antioxidant, immunomodulatory, antidiabetics, antiobesity, on cardiovascular effect. Water and ethanol was solvent used to extraction of the phytoconstituents. Physiochemical nature of *Triphala* extracts makes its active ingredients for oral delivery dosage forms. Numerous therapeutics applications make *Triphala* as polyherbal medicine.

KEYWORD: *Triphala*, antimicrobial, anticaring, wound healing, anticancer, antioxidant, immunomodulatory, antidiabetics, antiobesity, cardiovascular.

INTRODUCTION

Ayurveda were became the suitable alternative and most acceptable for treatment, prevention of various disease and disorder from ancient era. Ayurveda originated from the Sanskrit words Ayur means life and Veda means knowledge or sciences, therefore is called as the science of life. Ayurvedic medicine having wide biological and medicinal activities, great safety margin, and lower cost which offer countless mandates in the health care of developing countries.^[1] Most important advantage of that it's easy to produce from herbs and plants which readily available. Ayurveda cures the disease along with also rejuvenates our soul and mind which make it very effective and highly beneficial.^[2]

Triphala (Sanskrit; tri = three and phala = fruits) an ayurvedic herb was use as a natural medication for verity of heath condition. Also, well-recognized and esteemed polyherbal medication of dried fruits of the three plant species *Embllica officinalis* (Euphorbiaceae), *Terminalia bellerica* (Combretaceae), and *Terminalia chebula* (Combretaceae) that were a native to the Indian landmass. *Triphala* was evaluated as a tridoshic rasayana which applicable for Vata, Pitta, and Kapha or all kinds of patients.^[3] This review deals with the various type of *Triphala* with its important phytoconstituents and extraction process. Also review evaluation of *Triphala* containing dosage form with important pharmacological action.

***Triphala* Consist of**

***Embllica Officinalis* (*Amalaki*):** - Amalaki in Sanskrit was known to be as Dhatri (The nurse) having incredible healing properties. Also seen a beneficial role in cancer, diabetes, liver treatment, heart trouble, ulcer, anaemia, and various other diseases. It was used as an immunomodulatory, antipyretic, analgesic, cytoprotective, anti-tussive, and gastroprotective agent.^[4]

***Terminalia Bellerica*:** - It's also referred to as bastard myrobalan or beliric tree belongs to the *Combretaceae* family. It was showed antidiarrheal activity, analgesic activity, anti-microbial activity, anti-hypertensive activity, anti-salmonella activity, anti-oxidant activity and hepatoprotective activity. It also applicable to control the vital sign and cholesterol, promotes hair growth and prevent bleeding. Seeds consist of a high percentage of oil that used as a biofuel. It is also important constituent in a pickle and spice.^[5]

***Terminalia Chebula*:** - Synonym was chebulic myrobalan and Black myrobalan belongs to the *Combretaceae*. It was shows antioxidant activity, immunomodulatory activity, anti caries agent, anti-aging activities, anti-lithic activity, hypolipidemic activity, antidiabetic activity, hepato-protective activity, anti-ulcerogenic, anti-cancer and anti-microbial activities etc. Chebula powder-controlled cholesterol and varied wounds, improved digestion and employed in a toothpaste as tonic for stronger teeth.^[6]

Phytoconstituent of *Triphala*

Fruits of *T. chebula* was harvested within the spring, source 30-40% of tannins such as chebulic acid, chebulinic acid, neochebulinic acid, corilagin, chebulagic acid, ellagic acid, punicalagin, terchebin and terflavin A. Flavonoids like luteolin, rutin and quercetin *also contains in T. chebula* fruits.^[7] 40% protein and 35% oils omega-3 and -6 fatty acids (e.g., linoleic acid) was

present in *Terminalia bellerica* fruits. Plant may increase the extent of HDL and reduce LDL also simultaneously used for treatment of coronary artery disease.^[8] 445 mg per 100 g of ascorbic acid (vitamin C) was obtained from *P. Emblica*.^[9] High density of ellagitannins (diverse class of hydrolysable tannins) like emblicanin A, emblicanin B, punigluconin and pedunculagin responsible for bitterness.^[10]

Table 1: Main phytoconstituent of *Triphala*.

| BOTANICAL NAME | <i>Terminalia chebula</i> | <i>Terminalia bellerica</i> | <i>Phyllanthus Emblica</i> |
|----------------|---------------------------|-----------------------------|----------------------------|
| PHYTOCHEMICAL | Gallic acid | Gallic acid | Galloyl |
| | Tannic acid | Tannic acid | Mannitol |
| | Syringic acid | Ascorbic acid | Ascorbic acid |
| | Epicatechin | Beta – sitosterol | Gallic acid |
| | Ascorbic acid | Ellagic acid | Nicotinic acid |
| | Chebulinic acid | Chebolic acid | Ellagic acid |
| | Anthraquinone | | Linoleic acid |
| | Phosphoric acid | | Oleic acid |

Extraction of *Triphala* Phytoconstituent

Aqueous extract of *Triphala* was prepared by boiling followed by filtration using Whatman filter and centrifugation. Supernatant was lyophilised to form solid extract. While alcoholic extract was obtained by using soxhlets apparatus, extract was vacuum evaporated and dried at 40°C.^[11]

Pharmacological and Therapeutic Uses of *Triphala*.

1. Antimicrobial activity

Microbial causing infections which are tougher to treat by antibiotics because the development of resistance that leads to higher medical costs, prolonged hospital stays and increased mortality. *Triphala* and its constitution were evaluated a potential alternative for microbial treatment. *Triphala* shows inhibitory activity against *Streptococcus mutans* and *Lactobacillus*. *Triphala* and fruit components also having a potent antibacterial action against a good spectrum of bacterial like *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Shigella sonnei*, *Staphylococcus aureus*, *Vibrio cholerae*. Phenol and tannins in *Triphala* were evaluated more effective for arrests the growth of both gram-positive and gram-negative bacteria.^[12] Cream and nano emulsion hydrogel of *Triphala* hydroalcoholic extract alone or with carvacrol were prepared and evaluated as the antimicrobial formulation against selected microorganism strains including Gram-positive and Gram-negative bacteria and fungi. Comparative higher antimicrobial activity due increased in viscosity of nano emulsion hydrogel of *Triphala* hydroalcoholic extract and carvacrol by using Carbopol 940 was showed as compared to conventional cream formulation.^[13] Aqueous extract of *Triphala* revealed activity against *S. epidermidis*, *S. Aureus*, *P. Vulgaris*, also showed mildly antibacterial against *S. Typhimurium*, *B. subtilis* while against *E. coli* and against *E. aerogenes* showed negligible or no inhibitory effect. *Triphala* ethanolic extracts demonstrated maximum zone of inhibition against *Lactobacilli* and *C. albicans*.^[14] Potential

antibacterial by acetone, ethanol and methanol extracts of *Triphala* against wound pathogen *S. epidermidis*, *S. aureus*, *P. vulgaris* while against *E. coli*, *E. aerogenes* and *P. aeruginosa* were showed no antibacterial activity.^[15]

2. Anti Caries

Dental caries or cavity was a common infection to humans. As per WHO, estimated that 2.3 billion people suffer from caries of permanent teeth and more than 530 million children suffer from caries of primary teeth globally. Various clinical trials carried out to evaluated *Triphala* significantly decreases the greater number of oral bacteria, bacterial plaque, and gingivitis in human subjects. *Triphala* is effective against *Enterococcus faecalis*, one among the foremost difficult to eliminate oral pathogens that are commonly isolated in chronic periodontitis.^[15] *Triphala* (5 mg/mL) in 10% dimethyl sulfoxide (DMSO) was able to eliminating *E. faecalis* in vitro compared with NaOCl, a common irritant that used during root canals. It was observed that *Triphala* was more effective than 0.5% and 1% but equally effective as 2.5% and 5% NaOCl solution.^[17]

Ex vivo study antimicrobial on extracted human mandibular premolars by *Triphala* dissolved in 10% DMSO was exhibited a big antibacterial effect against *Streptococcus mutant* which is one of the most prevalent oral pathogens responsible for dental cavities.^[18] Compared with chlorhexidine gluconate germicidal mouthwash *Triphala* (6%) mouthwash promoted a big reduction in oral streptococcus colonies. Oral streptococcus levels were reduced by 17% using a 6% *Triphala* mouthwash while 44% using 0.2% chlorhexidine mouthwash twice per day for 48 h and 7 days. Significant reduction in oral streptococcus levels at 5 and 60 min after rinsing with 15 mL aqueous *Triphala* extract (10%) mouthwash observed in double-blind human clinical trial.^[19] *Terminalia chebula* is inhibited the sucrose-induced adherence and therefore the glucan-

induced aggregation that widely effective in prevention and treatment of several diseases of the mouth like cavity, spongy and bleeding gums, gingivitis, and stomatitis. *T. chebula* extract could successfully prevent plaque formation and inhibit the growth and accumulation of *S. mutans* on the surface of the teeth. In teenagers, *Triphala* (10%) mouthwash was reported very effective against dental plaque and gingivitis evaluated by double-blind, randomized human clinical trial. Also *Triphala* was found equally effective in antiplaque and anti-gingivitic activity compared with chlorhexidine.^[20] *Ex vivo* treatment tissue extracts by *Triphala* (1.5 mg/mL) inhibited metalloproteinases MMP-9 activity by 77% which was important alternative therapies in periodontitis treatment, while doxycycline (300 µg/mL) reduced MMP-9 activity by 59%.^[21]

3. Wound healing

Wound healing is a complex and dynamic process of replacing devitalized and missing cellular structures and tissue layers by new one. Various agents having a property to promote wound healing that included antibiotics, antiseptics, desloughing agents, chemical debridement, collagenase, wound healing promoters, tissue extracts, vitamins, minerals and number of plant products. *Triphala* was also successfully evaluated for wound healing property. In vivo study reveals significant wound closure property by ointments composing *Triphala* extract. The granulation shows reduced bacterial count, increase in collagen, hexosamine and uronic acid. *Triphala* shows high thermal stability, water uptake capability with faster wound closure and improved tissue regeneration due to incorporation of collagen sponges with *Triphala*. Epigallocatechin gallate interaction with collagen mainly contributes to express quick wound healing activity.^[22] Methanolic extract of *Triphala* reveals to matrix metalloproteinases expression, which was correlated well with the reduction in the inflammatory phase and confirmed efficient used as dressing on infected wound.^[23] In vitro study reveals activity against wound pathogens like *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Streptococcus pyogenes* by reduction of matrix MMP expression by gelatin zymography.

4. Anticancer

Phytochemicals naturally occurring compounds from plants were promising options to improve efficiency in cancer treatment and decrease adverse reactions over anticancer chemical. *Triphala* was evaluated as a potential adjunct within the management of colon and other cancers. Cell lines study showed a differential modulatory effect on normal and neoplastic cell lines also shows an increase in intracellular reactive oxygen species, but not normal cells. Excised tumour tissue from *Triphala*-fed mice compared with controls suggested that apoptosis induction may have mediated reduced in tumour growth.^[24] Methanol extract of *Triphala* suppressed proliferation and induced p53-independent apoptosis in human colon cancer stem cells.^[25] *Triphala*

inhibited HeLa (cervical adenocarcinoma), PANC-1 (pancreatic adenocarcinoma) and MDA-MB-231 (triple-negative breast carcinoma) cancer cells and suppressed the clonogenicity of HeLa cells.^[26] Antioxidant and reduces benzo(a)pyrene component, which is responsible for tumour incidences was significantly affected by constant consumption of *Triphala* in the diet which resulted in the chemo-preventive potential.^[27] *Triphala* also having a chemoprotective role against a highly toxic and carcinogenic compound (1,2-Dimethylhydrazine-dihydrochloride). Spectroscopic techniques such as mass spectroscopy, nuclear magnetic resonance and IR detected gallic acid as the major component responsible for cancer cell suppression.^[26]

5. Antioxidant

Free radicals which are produced from food breaks down, tobacco smoke or radiation which may seriously be responsible for heart disease, cancer and other diseases. Antioxidant agent was provided protective against free radicals and guard body cells from damage. In vitro and in vivo studies revealed *Triphala* having superoxide radical scavenging and hydroxyl radical-scavenging activity or antioxidants which play a crucial role in protecting the physical body against damages caused by reactive oxygen species (ROS).^[28,29] Alcoholic concentrate of *T. chebula* and *T. bellerica* extracts induce the assembly of ROS in macrophages mainly through the pro-phagocytic activity of acid. Same results were reported in studies with *P. Emblica* (amla) fruit extract.^[30] *Triphala* extract was found to be capable to inhibit H₂O₂-induced RBC haemolysis, nitric oxide production also shows high reducing power activity. *Triphala* was evaluated as pre-treatment medicine for human dermal fibroblast from H₂O₂-induced damage, also inhibits cellular senescence and protects DNA from damage.^[31]

Bromobenzene treatment in wistar albino rats resulted in reduction of the activities of antioxidant enzymes CAT, SOD, GST, and GPx as well as total reduced GSH in the kidney, also elevated the lipid peroxidation in the kidney of treated animals. However, oral administration of two different doses (250 and 500 mg/kg) of *Triphala* restored antioxidant enzymes and reduced lipid peroxidation in bromobenzene treated rats. Data implied that *Triphala* has nephroprotective effects through its antioxidant nature. Increasing an oral dose of *Triphala* to 1 g/kg resulted in decreased paw volume and lipid peroxidation; where antioxidant activity was found to be amplified in the plasma, liver, and spleen of monosodium urate crystal-induced mice compared to control mice.^[32]

6. Immunomodulatory

Immunomodulators help to modify the immune system activity which leads to anticipation of causing disease. Immunomodulatory activity of *Triphala* was attributed to flavonoids, alkaloids, tannins, saponins, glycosides and phenolic compounds, which were tested using

carbon clearance test and Delayed-Type Hypersensitivity (DTH) response. Study reveals that on administration of *Triphala* result in enhanced phagocytosis, phagocytic index, antioxidant activities and decreased corticosterone levels in an animal exposed to noise stress.^[33] *Triphala* were success as a useful for inflammatory stress because of its immunosuppressive activity that attributed to its inhibitory action on complement system, humoral immunity, cell mediated immunity and mitogen-induced T-lymphocyte proliferation, also able to prevented increase level of IL-4 as well as accurately decreased IL-2 and IFN- γ level.^[34]

7. Antidiabetic and Antiobesity

Diabetes widely often a health issue because it responsible for various a disease that increases the risk of death also diabetes-related complications can lower quality of life. *Triphala* proved to be useful in diabetic peoples by glycation which resulted successively protection from nerve damage or blindness. *Triphala* have able to inhibiting starch digestion and absorption as similar to that of diabetes drugs, such as miglitol and acarbose, resulted decreasing postprandial hyperglycaemia. In addition, capable to decreases the serum glucose levels in normal and alloxan-induced diabetic rats.^[35] A clinical study of non-insulin-dependent diabetes mellitus patients revealed that supplementation with 5 g of *Triphala* powder for 45 days significantly lowered blood glucose levels. Both fasting and postprandial blood sugar was reduced. Constituents in *Triphala* ellagitannins and Gallo tannins also responsible to enhance both PPAR-alpha and -gamma signalling, which increase insulin responsiveness and glucose uptake without inducing adipogenesis.^[36] *Triphala* extract in dose of 100mg /kg on oral administration was able to reduce the blood glucose level in regular and in alloxan induced diabetic rat significantly within 4 hours and also showed a sustained anti-diabetic effect on daily administration. Significant improvement in motor nerve conductivity rate and decreased the thermal, mechanical hyperalgesia also mechanical allodynia due to the *Triphala* treatment.^[37]

Obesity is presently one of the leading health challenges, worldwide. *Triphala* was evaluated as a safe and effective drug for the management of obesity. Gallic acid and phenolic constituents of *Triphala* was significantly decreased circumferential measures and body fat percentage and demonstrated a promising role in reducing weight that reported improvement in allied health ailments.^[38]

8. Cardiovascular

Cardiovascular problem was responsible for severely affecting blood supply to cell which must need for routing activity and affect the vital activity in human body. Animal study reveals *Triphala* able to reduced total cholesterol, low-density lipoprotein, very low-density lipoprotein, and free fatty acid levels in rats fed an atherogenic diet for 48 days.^[39] Cardiovascular

disease may be a leading explanation for mortality and morbidity worldwide, and hypercholesteremia is a crucial risk factor. Animal studies have reported the hypercholesteremic effects of *Triphala*. In one study, *Triphala* reduces the total cholesterol, low-density lipoprotein, very low-density lipoprotein, and free fatty acid levels in rats fed an atherogenic diet.^[39, 40] Network analysis was estimated that pretreatment with *Triphala* (20–80 $\mu\text{g/mL}$) could significantly inhibit the expression of PTGS2, MMP9 and IL6 responsible for cardiovascular disease. With increasing *Triphala* concentration, the expression of PTGS2, MMP9 and IL6 decreased.^[41]

9. Gut microbiome

Phytochemicals in *Triphala* such as quercetin, gallic acid and polyphenols such as chebulinic acid promote the growth of Bifidobacteria and Lactobacillus species while prohibit the growth of undesirable gut residents such as *E. coli*.^[42, 43] *Triphala* was extracted using solvents of varying polarity (methanol, water, ethyl acetate) and the antibacterial activity of the aqueous resuspensions was quantified by disc diffusion and broth microdilution MIC assays. Aqueous and methanolic extract of *Triphala* was displayed worthy inhibitory activity of MICs observed in the 250–750 $\mu\text{g/mL}$ range against all bacterial strains present in gut.^[44] *Triphala* was also evaluated as a better laxative as compared other natural laxation because of able to restoration of the epithelium lining of the digestive tract and facilitate passage of stool in the colon.^[45]

CONCLUSION

Triphala was proved to be poly herbal medicine because of enormous pharmacological effect. Numerous formulation comprising *Triphala* or its extracts was efficaciously formulated and evaluated. *Triphala* preparation also evaluated for *In vivo* pharmacological effect.

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