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A REVIEW ON POLYHERBAL FORMULATION OF TRIPHALA- THE AYURVEDIC WONDER

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ABSTRACT

Indian System of medicine has a longstanding history of using plants for the prevention and treatment of various health ailments. One of the most significant and efficient polyherbal formula acknowledged in ayurveda is triphala. Triphala is prepared by mixing the powdered fruits of amalaki (*Emblicaofficinalis*), haritaki (*Terminaliachebula*) and bibhitaki (*Terminaliabellerica*) or bahera in equal proportion. It is credited with diverse beneficial properties and has been reported to possess antioxidant, anti-inflammatory, antipyretic, analgesic, antimicrobial, antidiabetic, antimutagenic, anticariogenic, antistress, anticancer, antigout, hypolipidaemic, wound healing, radioprotective, gastroprotective, hepatoprotective, chemopreventive and immunomodulatory effects. The bioactive components responsible for these therapeutic potential are mainly due to the presence of ascorbic acid, carotene, gallic acid, ellagic acid, phyllembic acid, tannins, chebulagic acid, bellericanin, β-sitosterols, flavonoids. The present review focuses on summarizing the efficacy and innate power of the traditional medicine, triphala.

KEYWORDS: *Emblicaofficinalis*, *Terminaliachebula*, *Terminaliabellerica,* Traditional, Medicine.

INTRODUCTION

Medicinal plants, as source of remedies, are widely used as alternative therapeutic tools for the prevention or treatment of many diseases [Harnafi and Amrani, 2008]. Out of all the plants that have proved useful for humanity, a few are distinguished by their astonishing versatility [Subapriya and Nagini,2005].Ayurvedic physicians use Triphala for many ailments but most importantly to treat various gastrointestinal disorders. Scientific studies carried out in the past two decades have validated many of the ethnomedicinal claims and researches have shown Triphala to possess free radical scavenging, antioxidant, anti-inflammatory, antipyretic, analgesic, antibacterial, antimutagenic, wound healing, anticariogenic, antistress, adaptogenic, hypoglycaemic, anticancer, radioprotective and chemopreventive effects

[Manjeshwar et al.,2012].The fruit component of triphala are claimed to have antiviral, antifungal, antibacterial effects[Srikumar et al.,2007].Moreover Triphala is prescribed for various symptoms of infections, fatigue, assimilation and infectious diseases such as tuberculosis, pneumonia, AIDS and periodontal diseases[Wohlmuth , 2008; Abraham et al.,2005].

Triphala is equiproportional mixture ofdeseeded fruits of three medicinal herbs, *amalaki* (*Emblicaofficinalis*), *haritaki*(*Terminaliachebula*) and *bibhitaki*(*Terminaliabellerica*) [Kulkarni,1995].It is considered to be a universal panacea in the traditional Indian system of medicine the Ayurveda [Manjeshwar et al.,2012].Triphala is described as a 'tridoshicrasayan' having balancing and rejuvenating effects on the three constitutional elements that govern human life: Vata which regulates the nervous system, Pitta which maintains metabolic processes, and Kapha which supports structural integrity[Sharma and Dash,1998; Kaviratna and Sharma, 1996].

*Triphala*is traditionally been used as laxative in chronic constipation, colon cleansing, digestion problems and poor food assimilation. It has also been used in cardiovascular disease, high blood pressure disease, serum cholesterol reduction, poor liver function, large intestine inflammation, and ulcerative colitis[Anonymous, 1992].*Triphala*has been found to have wound healing[Kumar et al., 2010], anticancer [Sandhya et al., 2006], antimutagenic [Kaur et al.,2002], antibacterial [Tambekar and Dahikar, 2011], antigout [Sabina and Rasool,2008], hypolipidaemic [Dhanalakshmi et al.,2007] and antidiabetic [Sabu and Kuttan, 2002]activity. The individual herbs, used in the formulation are reported to have several other health benefits. *Terminaliachebula*(*T.chebula*) possesses antibacterial[Malekzadeh,2001]and antimutagenic [Kaur et al.,1998] activities. *Terminaliabelerica*(*T.belerica*) has antidiabetic [Sabu and Kuttan, 2002] and hepato-protective [Anand et al.,1997] activity. *Emblicaofficinalis*is reported to possess anti-inflammatory [Asmawi et al.,1993], antimutagenic [Kaur et al.,2002], antioxidant[Bhattacharya et al., 2000], cytoprotective [Sai et al.,2003], gastroprotective [Al-Rehaily et al., 2002]and hypolipidaemic [Mathur et al.,1996]activities.

Toxicity study showed that triphala was non-toxic up to a dose of 240 mg/kg, where no drug-induced mortality was observed. The LD50 dose i.p. of triphala was found to be 280 mg/kg body weight the optimum protective dose of triphala was 1/28 of its LD50 dose [Jagetia et al.,2002].*In* a study conducted to assess the antidiabetic potential , a dose of

triphala powder was decided as 5g twice a day and the duration of study was 90 days. Drug was well tolerated by the patients and it does not poses any toxicity [Mukherjee et al.,2006].



Fig. 1:***Emblicaofficinalis***Fig. 2:***Terminaliachebula***Fig.3:***Terminaliabellerica***

Taxonomy of the Components of triphala:

Binomial Name	***Phyllanthusemblica***	***Terminaliachebula***	***Terminaliabellerica***
Kingdom	Plantae	Plantae	Plantae
Subkingdom	Tracheobionta	Tracheobionta	Tracheobionta
Superdivision	Spermatophyta	Spermatophyta	Spermatophyta
Division	Magnoliophyta	Magnoliophyta	Magnoliophyta
Class	Magnoliopsida	Magnoliopsida	Magnoliophyta
Subclass	Rosidae	Rosidae	Rosidae
Order	Euphorbiales	Myrtales	Myrtales
Family	Phyllanthaceae	Combretaceae	Combretaceae
Genus	Phyllanthus	Terminalia	Terminalia
Species	Emblica	chebula	Bellerica
Synonym	*Emblicaofficinalis*,Amlaki, emblicmyrobalan, Indian gooseberry	Myrobalanus Chebula, Haritaki	MyrobalanusBellerica,Bahera, bibhitaki

[*http://plants.usda.gov/java/*]

Phytochemical constituents of Triphala:

*Chemical Constituents in Amlaki***:** It is an excellent source for vitamin C & also contains carotene, nicotinicacid, D-glucose, D-fructose, riboflavin, embicol, mucic & phyllemblic acids. Tannin, Procynidin, VitC, Ellagic acid, Carotene, Phyllantine, Riboflavin,Phyllembin, Polyphenolsand some fatty acids are also present in it.

Chemical Constituents in Haritaki: It contains Anthraquinoneglycoside, chebulinic acid, VitaminC, arachidinic acid, linoleic acid, oleic acid, palmitic acid, stearic acid,Tannin etc.

*Chemical Constituents in Bahera***:**It containschebulagic acid, ellagic acid & its ethyl ester, gallic acid, fructose, galactose, glucose, mannitol, rhamnose**,** β -Sitosterol, Tannin, Bellericaninetc [Satyavati et al.,1976; Sharma and Dravya, 1982].

Therapeutic properties:

Scientific studies carried out in the past two decades have validated many of the ethnomedicinal claims and researches have shown Triphala to be a Versatile Counteractive Assortment of Ailments.

A. Triphala as an antioxidant:

The methanolic extracts (75%) of *Terminaliachebula*, *Terminaliabelerica*, *Emblicaofficinalis* and their combination named Triphala were found to inhibitlipid peroxide formation and to scavenge hydroxyl and super oxide radicals in vitro. The concentration of plant extracts that inhibited 50% of lipid peroxidation induced with Fe2+/ascorbate werefound to be 85.5, 27, 74 and 69 µg/ml, respectively. The concentration needed for the inhibition of hydroxyl radical scavenging were 165, 71, 155.5 and 151 µg/ml, and that for super oxide scavenging activity were found to be 20.5, 40.5, 6.5 and 12.5 µg/ml, respectively[Sabu and Kuttan,2002].

A study suggested that *T.chebula*has a higher % of Gallic acid equivalents (358.54±5.24) as compared with *E.officinalis*(313.0±12.51) &*T.Belerica*(301.54±2.30). Their equimolar mixture *triphala*contains (335.29± 3.07) of Gallic acid equivalents. The total phenolic content is an indication of strong antioxidant activity[Sharma et al.,2012].Triphala and its individual components are capable of scavenging free radicals DPPH, superoxide, and nitric oxide[Naik et al.,2006].

B. Hypoglycaemic Potential of Triphala

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 [Sabu and Kuttan,2002].

Modern life style is characterized by high stress, increased automation, junk food consumption and sedentary life style which have lead to the incidence of Diabetes. A study was conducted which involved selection of NIDDM(Non Insulin Dependent Diabetes Mellitus) subjects who were supplemented with Triphala powder called, The Three Myrobalans (*Terminaliabellirica*- Belliricmyrobalan, *Terminaliachebula-Inknut*, *Embilicaofficinalis* - Indian gooseberry) for a period of 45 days. The blood profile showed significant reduction in the blood glucose level of the subjects [Rajan and Antony,2008].

C. Gastroprotective Effect of Triphala

Mixed types of response were observed with different preparations of Triphala both on bowel movement and well being. It has been observed that the amount, frequency and consistency of stool in triphala treated groups have improved significantly. No toxicity or adverse drug reactions were observed in the patients and hence triphala was found to be safe and effective during the clinical trial. The study disclosed the avenue properly for evaluating the therapeutic efficacy of a common preparation like 'Triphala' on constipated bowel habit and well-being [Mukherjee et al., 2006].

Triphala is categorized as rejuvenator and traditionally been used in various gastric disorders including intestinal inflammation. A study was conducted to examine the comparative gastroprotective effects of Triphala formulations against experimental gastric ulcer in rats .Gastric ulcer was induced by water immersion plus stress-induced ulcers in rats. The drug effects were assessed by studying macroscopic gross injury and stomach tissue biochemical parameters. Triphala showed significant antiulcer activity and this is evident from reduction of ulcer index, lipid peroxidation and hydroxyl radical levels and concomitantly raised levels of catalase and superoxide dismutase [Nariya et al.,2011].

The anti-diarrhoeal effect of aqueous and alcoholic extracts of Triphala and TriphalaMashi were studied employing castor oil-induced-diarrhoeal model in rats. The gastrointestinal transit rate was expressed as the percentage of the longest distance travelled by the charcoal divided by the total length of the small intestine. All the extracts, at various doses 200, 400 and 800 mg/kg displayed remarkable anti-diarrhoeal activity as evidenced by a significant increase in first defecation time, cumulative fecal weight and intestinal transit time [Birader et al.,2007].

D. Triphala as Hypolipidemic Agent

Rats which were fed with a diet consisting of 4% Cholesterol, 1% cholic acid and egg yolk for 48 days resulted in a significant increase in the total cholesterol, LDL, VLDL and FFA making them hypercholesterolemic. But administration of Triphala at 1g/ Kg body weight daily for 48 days caused significant reduction in total cholesterol, LDL, VLDL and FFA[Saravananet al.,2007].

E. Hepatoprotective Activity of Triphala

Triphala extract was observed to exhibit hepatoprotective effect as demonstrated by enhanced activities of antioxidant enzymes like superoxide dismutase, catalase, glutathione peroxidase, glutathione reductase and glutathione –s- transferase [Jose and Kuttan,2006].

Triphala extract (100 mg/ kg bw)significantly inhibited acetaminophen induced hepatotoxicity in mice as indicated by the decrease of serum aminotransferases, alkaline phosphatase, inflammatory mediater TNF-α (Tumour Necrosis Factor-α) and hepatic lipid peroxidation[Rasool et al.,2007].

F. Antibacterial Potential of Triphala

In a study the antibacterial activities of aqueous and ethanol extracts of Triphala and its individual components against *Pseudomonas aeruginosa, Klebsiellapneumoniae, Shigellaflexneri, Paratyphi- B, Escherichia coli, Vibrio cholera , Salmonella typhi , Staphylooccusaureus, Enterococcus faecalis, human immunodeficiency virus (HIV)* infected patients was confirmed.[Srikumar et al., 2007].

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[Bajaj and Tandon,2011].

G. Antiviral Potential of Triphala

Terminalia has been found to possess antiviral activity. Researchers have reported that Terminalia protects epithelial cells against influenza A virus, supporting the traditional use of Terminalia for aiding in recovery from acute respiratory infections[Badmaev and Nowakowski,2000].Terminalia has also demonstrated therapeutic activity against herpes simplex virus (HSV) in in-vivo tests[Yukawa et al.,1996].These findings prompted a team of Japanese researchers to investigate Terminalia's effects on human cytomegalovirus (CMV). They found that Terminalia was effective in inhibiting the replication of human cytomegalovirus (CMV) in vitro and in immune suppressed mice. Stating that "Terminaliachebula significantly suppressed MCMV (murine CMV) yields in lungs of treated mice," the researchers concluded that Terminalia may be beneficial for the prevention of CMV diseases in immune compromised patients [Shiraki et al.,1998].

H. Antifungal Property of Triphala

In a study the antifungal potential of fruit and powdered ingredients of triphalachurna, i.e. *Emblicaofficinalis* (Garetn.) (Amla), *Terminaliabellirica* (Gaertn.)Roxb. (Bahera) and *Terminaliachebula* (Retz.) was described. Water extracts of all the fruits and powdered samples were tested (in vitro) for their antifungal activities by poisoned food technique against different Aspergillus species (*A. flavus, A. fumigatus, A. versicolor, A. terreus and A. niger*) associated with them during storage. All extracts displayed varied levels i.e. very low to very high antifungal activities on four Aspergillus species. The aqueous extracts of fresh fruits (37.96 +/- 7.59%) was observed to be most effective than dry fruits (34.95 +/- 7.59%) and powder (25.07 +/- 6.05%). Terminaliachebula (fresh and dry) extracts were found most active against the four Aspergillus species with 49.15 and 40.8% inhibition, respectively. None of the extracts were found effective against the growth of A. niger. All fruits and powdered aqueous extracts were observed to be ineffective against the A. niger. [Gautam et al., 2012].

I. Antiobesity Potential of Triphala

A study was conducted to investigate the effects of triphala and its constituents (*T. bellirica* [bibhitaki], *T. chebula* [haritaki], and *E. officinalis* [amalaki]) on the dietary induction of obesity (diet-induced obesity [DIO]), and other symptoms of visceral obesity syndrome, in mice fed a high-fat diet (HFD).The research team obtained 42 fertile, male, Swiss albino mice, weighing 20 g each.The team divided the mice into six weight-matched groups of seven mice each: (1) normal diet (ND), (2) high-fat diet (HFD), (3) triphala (HFD+T), (4) amalaki (HFD+A), (5) haritaki (HFD+H), and (6) bibhitaki (HFD+B).All mice were fed with a HFD for 10 weeks beginning at 7 weeks of age ,except those in a control group (ND).The research team's results showed that mice fed a HFD for a 10-week period, supplemented with herbal preparation(s) of triphala or its constituents, resulted in significant reductions in body weight ($P < .0001$), energy intake, and percentage of body fat ($P < .001$), as compared with mice in the HFD group. Herbal treatment significantly improved the lipid profiles of the mice by lowering serum total cholesterol (Total-C), TG, and low-density lipoprotein cholesterol (LDL-C) and increasing levels of high-density lipoprotein cholesterol (HDL-C) as compared to the mice in the HFD group. The research team also found that herbal treatment attenuated glucose levels, oral glucose tolerance as measured by the oral glucose tolerance test (OGTT), and levels of ALT(Alanine Transaminase). In addition to

treatment with its three individual components, treatment with a popular Ayurvedic formulation of triphala also reversed the pathological changes in liver tissue and decreased the relative weight of visceral adipose fat pads[Gurjar et al.,2012].

J. Analgesic, Antipyretic and Ulcerogenic Activities

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[Deraedt, 1976].

K. Immunomodulatory Activity

Study by Srikumar et al. have shown that administration of Triphala enhanced the phagocytosis, phagocytic index and anti-oxidant activities and decreased corticosterone level in animals exposed to noise stress[Srikumar et al.,2005].

Triphala Mega extract when administered at 500 mg/Kg and 1000 mg/Kg orally showed an increase in carbonclearance index which reflects enhancement of phagocytic function of mononuclear macrophage and nonspecific immunity. There was an increase in DTHresponse or cell medicated immunity. Triphala mega extract had a stimulatory effect on T cells. The good immunomodulatory property of triphala could beattributed to flavonoids, alkaloids, tannins, saponin glycosides and phenolic compounds[Rinki and Mishra, 2011].

L. Wound Healing

Triphala extract ointment (10% w/w) was assessed for in vivo wound healing on infected rat model by rate of healing, bacterial count, biochemical analysis, and expression of matrix metalloproteinases. application of Triphala ointment on infected wound not only reduces the risk of infection but also improved the healing. The ointments prepared from triphala extracts show significant wound closure in vivo. The granulation tissue shows reduced bacterial count, increase in collagen, hexosamine, uronic acid[Muthusamy et al.,2008].

M. Anti-inflammatory and Antiarthritic Activity

Rasool et al. evaluated the antiarthritic effect of Triphala . The physical and biochemical changes observed in arthritic animals were altered significantly to near normal conditions after oral administration of Triphala (1g/kg body weight)[Rasool and Sabina,2007]. In other study Rasool studied the efficacy of Triphala on monosodium urate crystal induced inflammation in mice where significant inhibition in paw volume, levels of lysosomal enzymes, LPO(Lipid Peroxidation), and inflammatory mediator tumour necrosis factor –α was found[Sabina and Rasool, 2008].

N. Anticancer &Antistress Effect

Triphala supplementation has a protective effect against tress. 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[Dhanalakshmi et al., 2007].

Triphala prevents noise-stressinduced changes in antioxidant and cell mediatedimmune 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[Srikumar et al., 2006].

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 mousethymic lymphoma (barcl-95)[Kaur et al., 2002].

The action of Triphala as a prooxidant has been verified in cancer cells. Using DCH-FDA fluorescent probe, a significant increase in intracellular ROS level was detected in tumor cells, but not normal cells treated with Triphala [Sandhya*et al*., 2006].The induction of apoptotic death in tumor cells by Triphala seems related to the generation of cytoplasmic ROS subsequently leading to cellular oxidative damage (Figure 4).

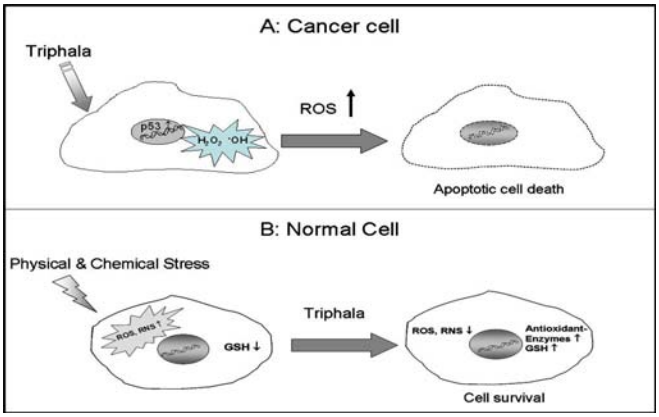

Fig 4.Paradoxical roles of triphala as prooxidant in cancer cell(A) and antioxidant in normal cell (B) (ROS: Reactiveoxygen species, RNS: Reactive nitrogen species, GSH:glutathione). [Sandhya et al., 2006]

O. Radioprotective Effect

The effect of 0, 5, 6.25, 10, 12.5, 20, 25, 40, 50 and 80 mg/kg b. wt. of aqueous extract of triphala (an Ayurvedic herbal medicine) administered intraperitoneally was studied on the radiation-induced mortality in mice exposed to 10 Gy of gamma-radiation. Treatment of mice with different doses of triphala consecutively for five days before irradiation delayed the onset of mortality and reduced the symptoms of radiation sickness when compared with the non-drug treated irradiated controls. The highest protection against GI (gastrointestinal) death was observed for 12.5 mg/kg triphala, where a highest number of survivors were reported up to 10 days post-irradiation [Jagetia,2002].

Conclusion

In the present era people are much more health conscious and fitness has become a religion for the young generation. At the same time changing environment and lifestyle are aggravating the occurrence of degenerative diseases. So instead of depending on synthetic drugs and vitamin pills, safe and natural alternatives can be used.

The extensive survey of literature revealed that triphala is a miraculous polyherbal formulation which can be used for the welfare of the mankind. Triphala can be used as a household remedy for several ailments as it is easily available and affordable by the people of all socio-economic group. The phyto constituents like Gallo-tannic acid, bellericanin, ellagic acid, gallic acid , termilignan, thannilignan, flavone and anolignan B, Tannins, ellargic acid, ethyl gallate, galloyl glucose andchebulaginic acid, phenyllemblin, β - sitosterol, mannitol,

glucose, fructose and rhamnose compounds were found to be responsible for many of the diverse pharmacological spectrum.

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