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Evaluation of Anti-Inflammatory and Wound-Healing Activities of Triphala: A Phytochemical and Extraction-Based Study of a Classical Ayurvedic Formulation

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ABSTRACT: Triphala, a classical Ayurvedic formulation composed of *Amalaki, Haritaki,* and *Bibhitaki*, is traditionally recognized for its *Shothahara* (anti-inflammatory) and *Vranaropana* (wound-healing) properties. The present study scientifically evaluates these activities using carrageenan-induced paw edema and excision wound models in Wistar rats. The ethanolic extract of Triphala demonstrated significant suppression of acute inflammation and significantly enhanced wound contraction and epithelialisation. These effects may be attributed to the presence of tannins, flavonoids, and phenolic compounds that support tissue repair, collagen formation, and antimicrobial action. The findings substantiate the classical Ayurvedic claims regarding the therapeutic potential of Triphala.

KEYWORDS: Triphala, Shothahara, Vranaropana, Ayurveda, Anti-inflammatory, Excision wound model, Rasayana

INTRODUCTION

Inflammation (Shotha) is described in Ayurveda as a protective yet potentially pathological response resulting from Dosha imbalance due to internal or external insults. In modern medicine, inflammation is recognized as a complex vascular and cellular process essential for tissue defense and repair; however, its dysregulation contributes to chronic diseases and delayed healing.

Ayurveda emphasizes the use of herbal formulations to regulate inflammation while promoting tissue rejuvenation. Triphala, a classical Rasayana formulation comprising Amalaki (*Emblica officinalis*), Haritaki (*Terminalia chebula*), and Bibhitaki (*Terminalia bellerica*), is traditionally employed for detoxification, immunomodulation, and restoration of physiological balance.

Phytochemically, Triphala is rich in polyphenols, flavonoids, tannins, and organic acids, including Gallic acid, chebulinic acid, and ellagitannins, which exhibit antioxidant, anti-inflammatory, and wound-healing

properties. Experimental studies have demonstrated its ability to reduce oxidative stress, suppress inflammatory mediators, and enhance immune responses.

Therefore, Triphala represents a promising Ayurvedic formulation with dual traditional and scientific relevance in inflammation management. The present study aims to evaluate its anti-inflammatory and therapeutic potential in detail.

MATERIALS, INSTRUMENTS & METHOD

Authenticated Triphala powder was procured from Vindhya Herbals, Sanjeevani Ayurveda, Bhopal, and stored in airtight containers. Analytical-grade chloroform, petroleum ether, and ethanol were used as extraction solvents. Instruments included a Soxhlet extraction unit, rotary vacuum evaporator, and digital pH meter.

Extraction and Phytochemical Screening

Triphala powder (25 g) was Soxhlet-extracted with 250 mL of each solvent at 50–60°C until complete extraction. Extracts were concentrated under reduced pressure and stored at 4°C after reconstitution in 0.25% chloroform water. Preliminary phytochemical screening was performed using standard methods.

Experimental Animals

Healthy Wistar albino rats (150–180 g) were maintained under standard laboratory conditions with free access to food and water. The study was approved by the Institutional Animal Ethics Committee as per CPCSEA guidelines (Approval No. 1196/a/08/CPCSEA).

Anti-inflammatory Activity (Shothaghna Karma)

Acute inflammation was induced by sub-plantar injection of 1% carrageenan (0.1 mL). Animals were divided into three groups (n=6): control, diclofenac sodium (10 mg/kg, i.p.), and ethanolic Triphala extract (100 mg/kg, p.o.). Paw volume was measured at 0, 1, 2, and 3 h using a plethysmograph, and percentage inhibition of edema was calculated.

Wound Healing Activity (Vrana Ropana Karma)

Excision wounds (314 mm²) were created on the dorsal region under mild anaesthesia. Animals were grouped as control, standard (5% povidone-iodine), and test (1% w/w Triphala extract). Treatments were applied topically for 14 days. Wound contraction and epithelialisation time were recorded to assess healing.

RESULTS

Phytochemical Screening

Phytochemical evaluation of Triphala extracts revealed the presence of multiple secondary metabolites (Table 1). The ethanolic extract showed the widest spectrum of constituents, while petroleum ether extract showed no detectable phytochemicals. Hence, the ethanolic extract was selected for pharmacological studies.

Table 1: Phytochemical Screening of Triphala Extracts

Phytochemical Tests	Chloroform	Ethanol	Petroleum Ether	Aqueous
Alkaloids	+	+	–	–
Carbohydrates & Glycosides	–	+	–	–
Phenolic & Tannins	–	+	–	+
Proteins & Amino acids	–	–	–	–

Phytochemical Tests	Chloroform	Ethanol	Petroleum Ether	Aqueous
Saponins	–	+	–	+
Terpenoids	+	+	–	+
Phlobatannins	–	+	–	–
Flavonoids	–	–	–	–

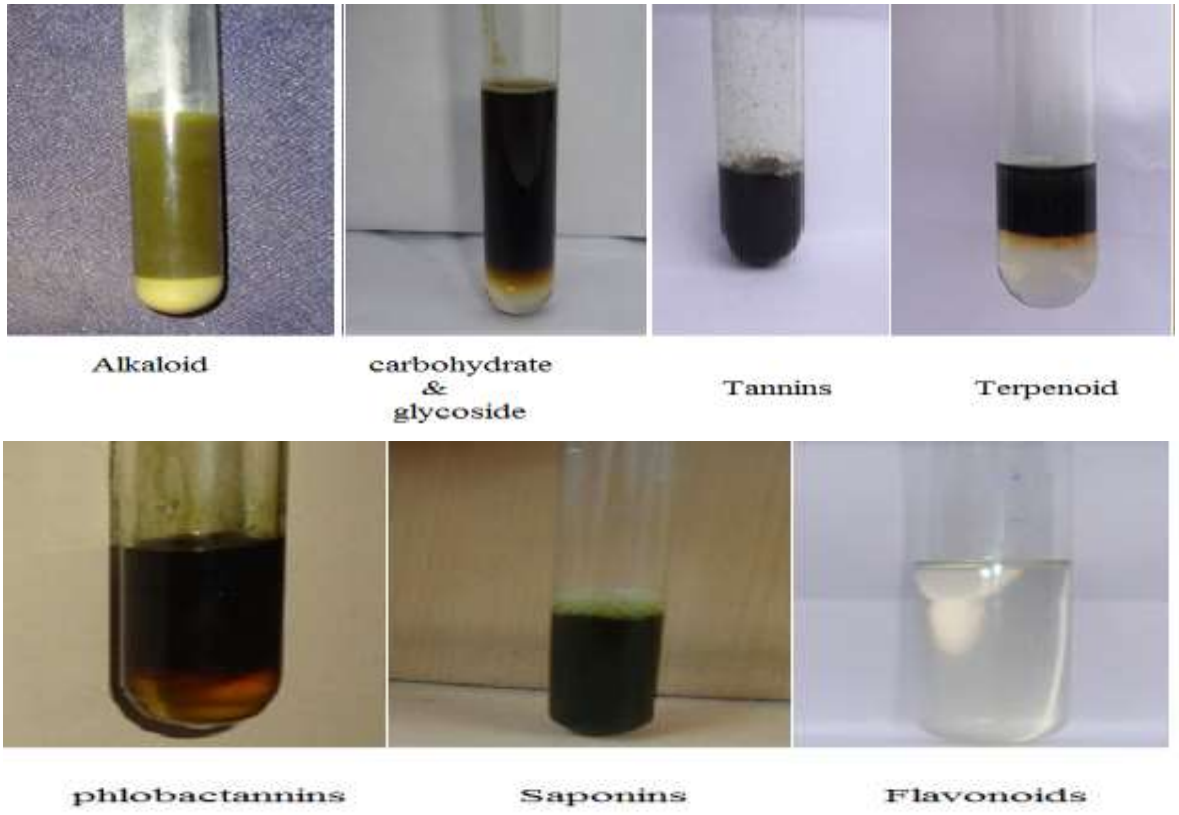

Fig :1 Phytochemical Analysis of Extract of Triphala
Fig :2 Phytochemical Analysis of Extract of Triphala
Fig.1 Phytochemical Activity of Triphala Extract

Anti- Inflammatory Activity (Carrageenan-Induced Paw Edema)

The ethanolic extract of Triphala (100 mg/kg) significantly reduced paw edema compared to the control group (Table 2). Diclofenac sodium showed maximum inhibition, validating the experimental model. The ethanolic extract exhibited better activity than the aqueous extract, confirming the Shothahara property of Triphala.

Table 2: Effect of Triphala Extract on Carrageenan-Induced Paw Edema

Group	Paw Volume (ml) at 0 h 1 h	2 h	3 h
Control	0.3	0.4	0.4	0.4
Diclofenac sodium	0.2	0.5	0.3	0.2
EE Triphala (100 mg/kg)	0.2	0.4	0.3	0.2
Aq. Triphala (100 mg/kg)	0.4	0.5	0.4	0.3

Fig: 2 Anti-Inflammatory Activity

Wound Healing Activity (Excision Model)

The ethanolic extract of Triphala significantly enhanced wound contraction and reduced epithelialisation time compared to the control group (Table 3). On day 14, wound area was lowest in the standard group, followed by the extract-treated group. Reduced epithelialisation time in the extract group supports its Vranaropana activity.

Table 3: Effect of Triphala Extract on Wound Healing

Group	Wound Area (mm^2) Day 3	Day 6	Day 9	Day 14	Epithelialisation Period (Days)
Control	275	205	155	90	19
Standard	205	140	95	50	15
Ethanol Extract of Triphala	230	145	110	60	17
Aqueous Extract of Triphala	255	180	150	80	22

Fig: 3 Excision Model of wound

DISCUSSION

Triphala is described in Ayurveda as a *Rasayana* with *Tridosha-shamaka* and *Shothahara* properties. The carrageenan-induced paw edema model used in the present study represents acute inflammatory *Shotha*, as described in classical texts. Triphala extract significantly reduced paw edema, particularly during the late phase of inflammation, indicating probable inhibition of prostaglandins and kinins, which are known mediators in this phase [13,15]. These findings support its traditional anti-inflammatory indication.

In the excision wound model, Triphala extract accelerated wound contraction and reduced epithelialisation time, reflecting effective *Vranaropana* activity. This may be attributed to the presence of tannins, flavonoids, triterpenoids, and polyphenols, which enhance collagen synthesis, promote angiogenesis, and improve local

immune response, thereby facilitating faster tissue repair [3,7,11]. Similar wound-healing and anti-inflammatory activities of Triphala constituents have been reported earlier [2,9].

Overall, the study provides experimental validation of the classical Ayurvedic claims of Triphala in the management of inflammation and wound healing, supporting its rational use as a therapeutic formulation.

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