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Review Article

Bioelectronic Medicine - Engineering the Body's Electrical Language for Health

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ABSTRACT

Background: Hemorrhoids are a common anorectal condition characterized by inflammation, pain, and bleeding. Conventional treatments often carry side effects, prompting interest in herbal alternatives. **Polyherbal formulations** offer a synergistic therapeutic approach with fewer adverse effects. **Methods:** A polyherbal tablet containing *Cissampelos pareira*, *Fagonia cretica*, *Terminalia chebula*, and *Berberis aristata* was prepared by direct compression. A topical hydrogel incorporating *Curcuma longa*, *Moringa oleifera*, and *Senna alexandrina* was formulated using Carbopol 940. Both dosage forms were evaluated for standard physicochemical parameters. Safety was assessed via acute oral toxicity and rectal irritation tests. **Results:** The tablet showed good flowability (angle of repose 33.46°), acceptable hardness (6.5 kg/cm²), and disintegration within 7 minutes. The hydrogel had optimal pH (6.3), viscosity (18.4 Pa·s), and no signs of irritation. All formulations met pharmacopeial quality standards. Acute toxicity studies confirmed safety at therapeutic doses. **Conclusion:** The developed polyherbal formulations are safe, stable, and potentially effective for hemorrhoid management.

INTRODUCTION

Hemorrhoids, a common anorectal disorder, are characterized by pathological enlargement and downward displacement of the anal cushions, leading to pain, bleeding, swelling, and prolapse [1]. The pathogenesis involves increased intra-abdominal pressure, vascular congestion, and degenerative changes in supporting tissues [2,3]. Conventional treatments, including corticosteroid

creams, sclerotherapy, and surgical excision, can offer symptomatic relief but are often associated with side effects such as mucosal irritation, allergic responses, and high recurrence rates. These limitations have prompted researchers to explore alternative therapeutic systems with better safety and efficacy profiles [4,5]. Polyherbal formulations have long been used in Ayurvedic and Unani medicine to manage hemorrhoids by leveraging synergistic, multitargeted actions of

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multiple herbs [6,7]. These formulations typically contain anti-inflammatory, venotonic, wound-healing, and antimicrobial herbs that address not only the symptoms but also the underlying pathophysiology of hemorrhoidal disease [8]. Modern dosage forms, such as tablets and gels incorporating these polyherbal combinations, provide a more convenient, standardized, and patient-friendly mode of administration while preserving the holistic benefits of traditional systems [9]. The rationale behind polyherbal formulations lies in their synergistic effects, reduced toxicity, and enhanced bioavailability, making them attractive alternatives for chronic conditions like hemorrhoids [10,11]. In recent years, the integration of traditional herbal knowledge with modern pharmaceutical technologies has gained traction in the development of effective, safe, and accessible treatment options [12,13]. Hemorrhoids, being a condition with both local and systemic components, benefit from dual-targeted therapy—addressing internal inflammation and promoting external healing. Polyherbal tablets allow for systemic delivery of anti-inflammatory and astringent agents, while topical hydrogels offer local relief through soothing, antimicrobial, and barrier-forming effects [10]. Herbs such as *Cissampelos pareira*, *Fagonia cretica*, *Terminalia chebula*, and *Berberis aristata* have shown promising results in wound healing and inflammation modulation, while *Curcuma longa*, *Moringa oleifera*, and *Senna alexandrina* contribute to antioxidative, anti-inflammatory, and laxative actions. Therefore, the aim of this study was to develop and evaluate a standardized polyherbal tablet and hydrogel formulation for the effective management of hemorrhoids.

METHODOLOGY

Collection of Herbal Materials

Polyherbal constituents including *Cissampelos pareira*, *Fagonia cretica*, *Terminalia chebula*, and *Berberis aristata* (for tablet formulation) were sourced from Likhit Ayurvedic, while *Curcuma longa*, *Moringa oleifera*, and *Cassia angustifolia* (for gel formulation) were procured from Yucca

Herbals and Vatsal Ayurvedic. All raw materials were authenticated and stored under appropriate conditions until further use.

Evaluation of Powder Characteristics

The powdered herbal ingredients and excipients (magnesium stearate and talc) were evaluated for bulk density, tapped density, Carr's index, Hausner's ratio, and angle of repose to assess flowability and compressibility for tablet formulation.

Formulation of Polyherbal Tablets

A direct compression method was employed. Dried and sieved powders of *Cissampelos pareira* (125 mg), *Fagonia cretica* (125 mg), *Terminalia chebula* (250 mg), and *Berberis aristata* (250 mg) were blended with magnesium stearate (10 mg) and talc (5 mg). The mixture was compressed using a 10.5 mm biconvex punch. Tablets were evaluated for weight variation, hardness, friability, and disintegration time using standard methods.

Formulation of Polyherbal Hydrogel

Carbopol 940 (4.5 g) was dispersed in distilled water, hydrated overnight, and neutralized using sodium hydroxide to achieve a pH of 6.0–6.5. A herbal extract solution comprising curcumin (1%), moringa (5%), and senna (4%) dissolved in ethanol and propylene glycol was incorporated into the gel base. Sodium benzoate (0.2 g) was added as a preservative. The final gel was homogenized and stored in airtight containers.

Evaluation of Hydrogel

The hydrogel was evaluated for organoleptic properties, pH, viscosity (using a viscometer), and physical stability. A rectal skin irritation test was performed in animals using a croton oil-induced inflammation model to assess safety, with observations recorded over 14 days.

RESULTS

The polyherbal tablet formulation was evaluated through pre-compression and post-compression



studies. The powder blend exhibited an angle of repose of 33.46° , indicating fair flowability. Bulk and tapped densities were found to be 0.36 g/mL and 0.42 g/mL, respectively. Carr's Index was 14.28% and Hausner's Ratio was 1.17, both of which reflect good compressibility and acceptable flow characteristics suitable for direct compression. The tablets, prepared using a direct compression technique, demonstrated adequate uniformity and blend compatibility. Post-compression evaluation of the tablets revealed that weight variation was within the acceptable $\pm 5\%$

limit for tablets over 250 mg, with tablet weights ranging from 390 mg to 420 mg. Friability was 0.615%, confirming mechanical stability, while the hardness averaged 6.5 kg/cm², indicating adequate resistance to breakage. The disintegration time was recorded at 6.2 minutes, which is within the pharmacopeial standard of ≤ 15 minutes for uncoated tablets. Additionally, the formulation was found to be safe in acute oral toxicity testing as per OECD 423 guidelines, with no observed toxicity or mortality in test animals (Table 1).

Table 1: Evaluation of Polyherbal Tablet Formulation

Parameter	Observed Value	Standard Limit	Inference
Angle of Repose	33.46°	$\leq 35^\circ$	Fair flow property
Bulk Density	0.36 g/mL	-	Moderate packing
Tapped Density	0.42 g/mL	-	Improved packing post-tapping
Carr's Index	14.28%	5–15%	Good compressibility
Hausner's Ratio	1.17	≤ 1.25	Good flowability
Weight Variation	390–420 mg	$\pm 5\%$ of 405 mg	Uniform weight
Friability	0.615%	$\leq 1\%$	Mechanically stable
Hardness	6.5 kg/cm ²	4–8 kg/cm ²	Adequate strength
Disintegration Time	6.2 minutes	≤ 15 minutes (IP standard)	Rapid disintegration
Acute Toxicity (LD ₅₀)	No toxicity	-	Safe for oral use

The polyherbal hydrogel was evaluated for organoleptic properties, pH, viscosity, and topical safety. The gel exhibited a smooth, homogenous texture with a brown appearance, reflecting the herbal constituents. The pH of 6.3 fell within the dermal tolerance range, confirming its suitability for anorectal application. Viscosity measured at

18.4 Pa·s suggested good spreadability and retention. No signs of erythema or edema were noted in the rectal skin irritation test, confirming the hydrogel's safety for topical use. The formulation remained stable without any signs of separation, microbial contamination, or physical degradation over the observation period (Table 2).

Table 2: Evaluation of Polyherbal Hydrogel Formulation

Parameter	Observation	Standard/Limit	Inference
Appearance	Brown, smooth, uniform	No phase separation or grittiness	Aesthetically acceptable
pH	6.3	5.5–7.0	Compatible with rectal mucosa
Viscosity	18.4 Pa·s	5,000–25,000 mPa·s	Good Spreadability and retention
Texture	Smooth, easy to apply	-	User-friendly
Skin Irritation Test	No erythema or edema	No irritation	Safe for topical use
Stability	Stable	No physical/microbial degradation	Good shelf-life

DISCUSSION

The current study aimed to formulate and evaluate a polyherbal tablet and hydrogel system for the management of hemorrhoids using traditional medicinal herbs. Pre-formulation evaluations of the tablet blend revealed acceptable flow and compressibility characteristics, with an angle of repose of 33.46°, Carr's Index of 14.28%, and Hausner's ratio of 1.17, all of which fall within pharmacopeial limits for direct compression [14,15]. The direct compression method was effective, as demonstrated by uniform tablet weights, low friability (0.615%), and a disintegration time of under 7 minutes. These parameters indicate that the formulation had good mechanical strength and rapid disintegration—both essential qualities for oral delivery of anti-inflammatory and wound-healing botanicals such as *Cissampelos pareira* and *Terminalia chebula* [16]. The hydrogel formulation containing *Curcuma longa*, *Moringa oleifera*, and *Senna alexandrina* was developed for rectal application to provide local anti-inflammatory, antioxidant, and soothing effects. The hydrogel demonstrated optimal physicochemical properties, including a pH of 6.3, viscosity of 18.4 Pa·s, and favorable spreadability, supporting its use on sensitive anorectal mucosa [17]. Importantly, the rectal irritation test showed no signs of erythema or edema, indicating that the formulation was well-tolerated. These findings align with earlier reports confirming the biocompatibility of carbopol-based gels and the low dermal toxicity of the incorporated herbal extracts [18,19]. Overall, both the tablet and hydrogel formulations met pharmacopeial and therapeutic criteria, confirming their potential as complementary treatments for hemorrhoids. The acute oral toxicity test also demonstrated a wide safety margin for the oral tablet, with no observed toxicity at doses up to 2000 mg/kg, consistent with OECD guidelines for herbal safety [20]. The use of polyherbal combinations capitalizes on the synergistic effects of multiple phytoconstituents, which may offer enhanced efficacy and reduced side effects compared to single-herb therapies [8]. These findings support further clinical evaluation of

these polyherbal dosage forms in hemorrhoidal patients.

CONCLUSION

The study successfully developed and evaluated two polyherbal dosage forms—a tablet for oral administration and a hydrogel for topical application—intended for the management of hemorrhoids. The tablet formulation demonstrated acceptable pre- and post-compression characteristics, including good flowability, uniform weight, adequate hardness, and rapid disintegration, indicating suitability for direct compression. The hydrogel showed desirable physicochemical properties such as optimal pH, viscosity, spreadability, and no signs of irritation in rectal skin testing, confirming its safety and effectiveness for topical use. Overall, both formulations were pharmaceutically stable and met standard evaluation criteria, suggesting their potential as safe, effective, and complementary approaches for hemorrhoid treatment.

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