WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
Coden USA: WJPRAP Impact Factor 8.453
Volume 15, Issue 3, 1585-1595. Research Article ISSN 2277–7105

"RUMEX HASTATUS" ANTIBACTERIAL OINTMENT FORMULATION AND DEVELOPMENT

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Article Received on 05 Jan. 2026,
Article Revised on 25 Jan. 2026,
Article Published on 01 Feb. 2026,

https://doi.org/10.5281/zenodo.18480378

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How to cite this Article: Bobby Rawat[1*]. (2026). "Rumex Hastatus" Antibacterial Ointment Formulation And Development. World Journal of Pharmaceutical Research, 15(3), 1585–1595.

ABSTRACT

The present study was aimed at formulating and evaluating an antibacterial herbal ointment prepared from the leaves and stem extract of *Rumex hastatus*. The plant material was collected, authenticated, shade-dried, powdered, and extracted using hydroalcoholic solvent by cold maceration. The obtained extract was incorporated into a standard ointment base using mechanical incorporation to prepare a 50 g herbal formulation. The prepared ointment was evaluated for various pharmaceutical parameters, including organoleptic properties, pH, spreadability, washability, viscosity, and stability. The formulated ointment exhibited smooth consistency, brownish color, homogeneity, good spreadability, easily washable nature, and a pH of 6.2, which is suitable for topical application. The formulation remained stable under different temperature conditions. The study concludes that *Rumex hastatus* possesses strong potential for developing an effective antibacterial topical formulation. Further studies on antimicrobial activity, long-term stability, and clinical safety could support its future pharmaceutical and therapeutic application.

KEYWORDS: Rumex hastatus; Herbal ointment; Antibacterial activity; Hydroalcoholic extract; Ointment formulation; Spreadability; pH evaluation; Herbal medicine; Topical preparation; Herbal therapeutics.

INTRODUCTION

Ointments are soft, semisolid mixture that are applied to the skin. They usually contain natural ingredients, & the main part of an ointment is called the base, which acts as a carrier for these ingredient.[1] An ointment is a thick, smooth, oily cream made mostly of oil (about 80 %) & some water (about 20 %). Ointments are good for keeping the skin moist & are often used to protect the skin or help it heal. They can be use on different parts of the body, such as the skin, eyes, chest, nose.[2]

Antibacterial activity is the ability of a substance to inhibit or kill bacterial cells. Different types of antibiotics and chemotherapeutic agents are being used in the treatment of one form of disease or the other. Most of these antibiotics were originally derived from micro-organisms while the chemotherapeutic agents are from plants. However, nowadays these antibiotics and chemotherapeutic agents are obtained by various synthetic processes (Reiner, 1984). Nepal is richly blessed with forests containing arrays of different herbs, shrubs and trees. The leaves, stems, bark and roots of these plants are being used by the local populace and people with thin income for incurring different types of ailments because of the inadequate medical facilities across the country.[3]

Microorganism like bacteria can cause skin problems such as rashes, acne, eczema, & dermatitis. The main bacteria that cause skin infection are *Staphylococcus aureus* & *Escherichia coli*. Ointment that has antibacterial properties can help treat & prevent infection caused by these bacteria.[4]

The Indian subcontinent is enriched by a variety of flora- both aromatic and medicinal plants. Herbal drugs constitute a major part in all the traditional systems of medicine. There are approximately 1250, Indian medicinal plants, which are used in formulating therapeutic preparation according to Ayurveda and other traditional system of medicine. This work has been an approach to formulate a modern Ayurveda formulation with single and double drug combination. Both the formulations are found to be very efficacious in all the parameters which was conducted for its characterization and also found enhance antimicrobial property.

This study may give a brief importance for modernization of Ayurveda preparation and also the importance of some herbs which can be distinct within some time period.[5]

According to survey report by WHO, about 25 per cent of prescribed human medicines are derived from plants and 80 per cent people still depend on traditional system of medicines.

The herbal wealth of India and the knowledge of their medicinal properties have a long tradition, as referred in Rigveda and other ancient literature. The topography of India in the tropical belt with its varied climatic zones made it a vast storehouse of medicinal plants.[6]

Herbal medicine, also called botanical medicine or phytomedicine, refers to the use of any plant's seeds, berries, roots, leaves, bark, or flowers for medicinal purposes. Long practiced outside of conventional medicine, herbalism is becoming more mainstream as up-to-date analysis and research show their value in the treatment and prevention of diseases.[7]

Structure and Function of Skin: It receives around one-third of the blood flow through the body and has glands, hair, and nails. Per square centimeter of human skin, there are 200–250 sweat ducts and 40–70 hair follicles on average.[8] The most significant function of skin is that it serves as an external barrier to the environment, allowing and restricting the passage of water, electrolytes, and other substances while safeguarding against microorganisms, ultraviolet radiation, toxic agents, and skeletal remarks and regulating body temperature. Skin has direct interaction with the exterior surroundings.[9] Three layers make up the skin. The dermis beneath the epidermis (1-2 mm), which often contains a lot of fat, is firmly linked to and supports the epidermis (70-150 mm).[10] Tough connective tissue, hair follicles, and sweat glands are all found in the dermis, which is located beneath the epidermis. The flexibility of the skin is provided by elastin fibres, which are loosely organized in all directions, the deeper subcutaneous tissue (hypodermis) is composed of connective tissue and fat.[11]

Epidermis: The skin's epidermis, which is its outermost layer, is broken down into the following five layers from top to bottom. These layers are distinguishable as:

Stratum Corneum- It is sometimes referred to as the horny layer and is made up primarily of Keratinocytes, which are flat squamous cells that carry the protein keratin. The substantial covering keeps microorganisms from entering and prevents water loss. Regional differences in thickness may exist. New cells from the stratum basale are regularly lost from this layer to replace it. There are roughly 15 to 20 layers.[12]

Stratum Luciderm- It is only prevented by the thick skin of the palms and soles and is made up of flattened epithelial cells and a clear covering of dead cells. It possesses waterproof qualities in addition to serving as a barrier.

Stratum Granulosum- It is also referred to as the granular layer and is made up mostly of stratified squamous cells that are stacked in rows of one to three and include lamellar granules and tono-fibrils.

Stratum Spinosum- It is often referred to as the "spinous layer" and is made up primarily of cuboidal cells grouped in many layers, which produce keratins that serve as structural supports. Desmosomes, specialized cells, bind the cells to one another. It gives the skin elasticity and strength.[13]

Stratum Basale or Stratum Germinatum-It is referred to as the basal cell layer and is the epidermis's innermost layer. Tall columnar cells that are constantly dividing with assistance from fresh keratinocytes that will take the place of those lost from the stratum corneum make up the layer. About 27 days pass with this procedure.[14]

Dermis: After the epidermis, the dermis is the skin's second-thickest layer. Because the dermis contains elastic fibers, the skin has the ability to stretch.[15] Due to the numerous collagens, it provides strength. The blood arteries in the dermis are responsible for supplying nutrients to the epidermis and dermis layers of the skin. The dermis has a breadth of 3-5 mm. It serves as a link between various skin layers on the body. Fibroblast (which creates collagen cells), Macrophages (which produce scavenger cells), and Mast cells are some of the cells found in the dermis.[16]

Hypodermis: It is the bottom layer, primarily made of fat (adipose), which protects the body from harm, generates heat, and acts as a cushion.

Penetration Pathway: Different routes of administration are used in order to provide the desired therapeutic response to the medication needed to treat the ailment. The types and severity of the disease determine the appropriate administration routes. The trans epidermal route and the route through pores are the two main routes that the medication enters the stratum corneum. Transcellular and intercellular routes make up the transepidermal pathway.

Transcellular (Intracellular Penetration): It is described as the movement of medications across the GI epithelium. It is the most typical route for the transportation of drugs. Most hydrophilic medications penetrate the stratum corneum. Water gathers close to the protein filaments' outer surface as soon as the cells of the stratum corneum hydrate, and this immobilised water facilitates the passage of polar molecules.

Paracellular (Intercellular Penetration): It is described as the movement of medications across GI epithelial cell junctions. Between the protein filaments, a non-aqueous lipid matrix dissolves in and allows nonpolar molecules to diffuse through it.[17]

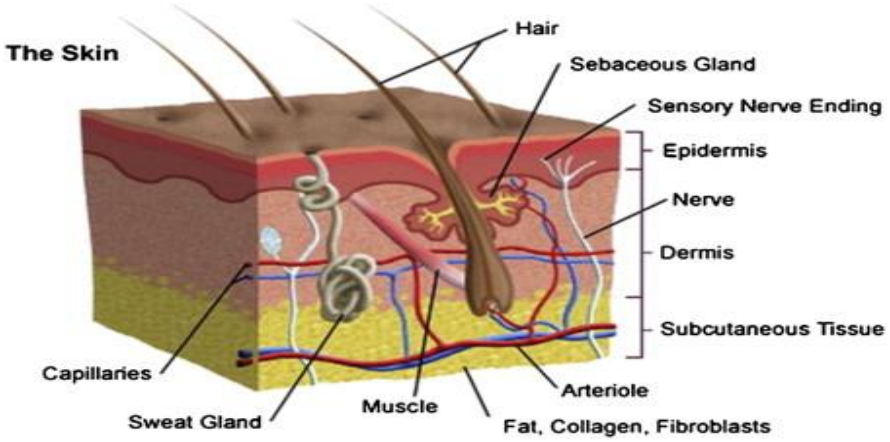

Fig 1- Structure of Skin.

Rumex hastatus

Fig 2- *Rumex hastatus* Plant.

Medicinal properties of plants played a significant role in the existence of primordial societies for their reliability on local plants for curing different ailments. Increased resistance against antibiotics persuaded scientific community to evaluate novel plants for the development of herbal drugs with more efficacies and a lesser amount of side effects. Therefore, in this study, the *Rumex hastatus* plant was used that belongs to the family

Polygonaceae. It is a herbal plant; and is widely distributed in Pakistan, Afghanistan, and China. This plant possesses several biologically active compounds, especially antioxidants, having many therapeutic properties like wound healing, jaundice, arthritis, and diarrhea dysentery, antitumor and cytotoxic activities. Despite the documented potential of the plant for curing tumors and cancers, the detailed studies reporting its therapeutic capabilities of are still scarce. The plant has been used as antioxidants to treat liver injuries. However, there is no such study reporting the hepatoprotective effect of the leaves of this plant against toxicity in Mice. So, taking it as an initiative, this work is intended for demonstrating the hepatoprotective activity of RH AgNO3 nanoparticles against CCl4 induced hepatotoxicity in male Albino Mice.[18]

Chapter 2- Objectives

1. To collect and authenticate the plant for medicinal use.
2. To prepare the extract of *Rumex hastatus*
3. To formulate antibacterial herbal ointment
4. To evaluate the ointment formulation

Chapter 4- MATERIALS AND METHODS

Plant material

The leaves & stem of the plant were collected, cleaned, and dried in the shade. Once completely dry, they were ground into fine powder by hand and then using a grinder to make it even finer. The powdered plant material was stored in airtight containers for later use.

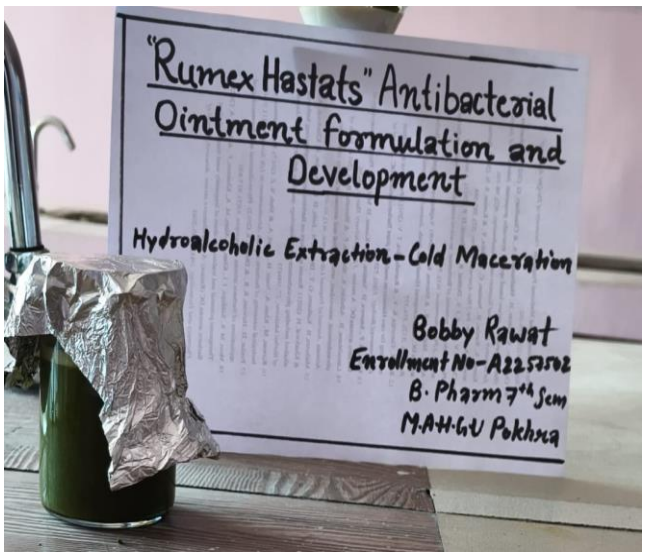

Fig 3- Extraction of *Rumex hastatus.*

Extraction process (Cold Maceration)

For extraction, 200 g of the powdered plant material was placed inside the beaker. About 100 ml of ethanol & 100 ml of water was added slowly. Cover the beaker and kept for 48 hour, after which extract is filtered. After the extraction was completed, the hydroalcoholic extract was collected in a china dish. The remaining solvent was then removed using a water bath to get the concentrated plant extract.[19]

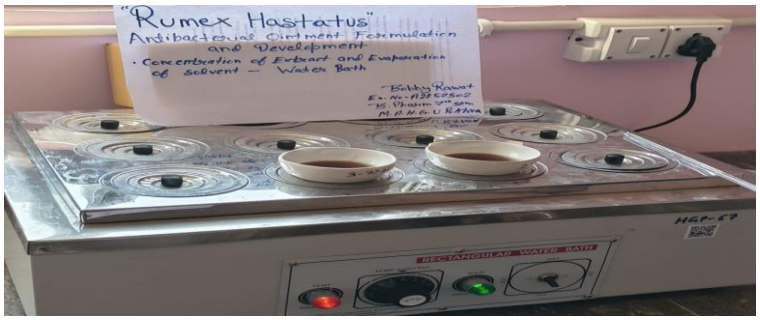

Fig 4- Concentration of extract on Water bath.

Procedure for preparation of Herbal Ointment

(a) Initially ointment base was prepared by weighing accurately grated hard paraffin which was placed in china dish on water bath. After melting of hard paraffin remaining ingredients were added and stirred gently to aid melting and mixing homogeneously followed by cooling of ointment base.

(b) Herbal ointment was prepared by mixing accurately weighed *Rumex hastatus* extract to the ointment base by mechanical corporation method to prepare a smooth paste with 2 or 3 times its weight of base, gradually incorporating more bases until to form homogeneous ointment, finally transferred in a suitable container.[20]

S.No.	Name of ingredient	Quantity to be taken
1	Cetosterylalcohol	3,5gm
2	Lanolin	4.5gm
3	Paraffin liquid	3.5gm
4	Petroleum gelly	32.5gm
5	Rumexhastatus	6gm
Total		50gm

Evaluation of Ointment (Easy Version)

The prepared ointments were checked for appearance, smell, color, smoothness, pH, spreadability, hardness, water absorption, and viscosity.

1. Organoleptic (Appearance) Characteristics

Both blank (without drug) and drug-containing ointments were checked for:

- Color, appearance, and texture
- Phase separation (whether layers separate)
- Smoothness and homogeneity

These were examined by simply looking at the ointment and rubbing a small amount between the thumb and index finger. The feel on the skin—like stiffness, grittiness, and greasiness—was also observed.

2. pH Measurement

- About 2.5 g of ointment was taken in a dry beaker.
- 50ml of water was added.
- The mixture was heated in a water bath at 60–70°C.
- The pH was measured using a pH meter.
- Measurements were done three times, and the average value was taken.

3. Spreadibility

Spreadibility shows how easily the ointment spreads.

METHOD

- 3 g of ointment was placed on a glass plate.
- Another glass plate was placed on top.
- 1 kg weight was kept on it for 5 minutes to make a uniform layer.
- Excess ointment was removed.
- The top plate was pulled with a 240 g weight, and the time taken to move 10 cm was recorded.

Formula:

$S = M \times L/T$

Where,

S = Spreadability

M = Weight (g) pulling the top plate

L = Distance moved (cm)

T = Time taken (seconds)

Shorter time = better spreadibility.

4. Viscosity

Viscosity tells how thick the ointment is.

METHOD

- 50 g of ointment was put in a beaker and left for 5 min.
- A Brookfield Viscometer (Model RVT) with a T-D spindle was used.
- Readings were taken at different speeds (10–100 rpm).
- Then the spindle speed was lowered and readings were taken again.
- All readings were taken three times.
- Viscosity (in centipoise, cps) was calculated by multiplying the dial reading with the factor given in the viscometer manual.[21]

Chapter 5- Result and Conclusion

RESULT

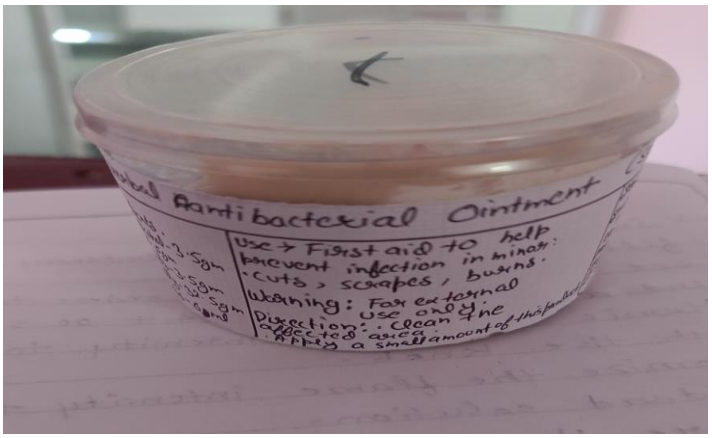

Fig 5- *Rumex hastatus* Ointment.

Appearance	Smooth and homogenous
Colour	Brownish
Consistency	Smooth
pH	6.2
Spreadibility	Good
Washability	Easily washable
Stability	Stable at different temperature

CONCLUSION

The project successfully demonstrated that *Rumex hastatus* can be effectively formulated into an antibacterial ointment. Further studies involving long term stability, antibacterial potential, clinical safety and large scale formulation may support its future pharmaceutical application.

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