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Ethanopharmacology, Pharmacognostic Exploration, Formulation and Evaluation of A Topical Gel Containing *Euphorbia Hirta* Linn Plant Extract

Research Article

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Abstract

The medicinal plant *Euphorbia hirta* Linn, commonly referred to as asthma weed or pill-bearing spurge, can be found across tropical and subtropical regions. Its bioactive elements, which include flavonoids, alkaloids, tannins, and saponins, have been accountable for its medicinal qualities and have been utilised in traditional medicine for quite a while. A wide range of pharmacological actions, including anti-inflammatory, antibacterial, antifungal, antioxidant, and antidiabetic properties, have been demonstrated for *E. hirta*. Because of its broncho-dilatory and expectorant qualities, studies have also shown that it may help with respiratory ailments like cough, bronchitis, and asthma. *E. hirta* exhibits promise in the treatment of gastrointestinal issues, skin ailments, and a number of inflammatory conditions in addition to respiratory health. In order to fully investigate *E. hirta's* medicinal potential, it is crucial to combine traditional knowledge with contemporary scientific study. To gain a greater understanding of the plant's significance in modern medicine. In the current investigation, the ethnopharmacological assessment of the plant has been conducted. The formulation and subsequent evaluation of a topical anti-inflammatory gel incorporating Euphorbia hirta Linn. extract has been performed.

Keywords: *Euphorbia hirta,* Traditional medicine, Phytochemicals, Anti-inflammatory, Topical gel.

Introduction

Euphorbia hirta L. belongs to family *Euphorbiaceae* (1). It is commonly called as Asthma weed in English, Dugdhika, Kshirini, Ksheerani, Svaduparni in Sanskrit, Dudhi in Hindi and Marathi. It is also called as Australian asthma her (2, 3).

The Indo-Pakistan subcontinent is home to it, and it is primarily found in roadside waste areas (1). These plants are distinguished by the presence of a milky white, mostly poisonous latex (4). Throughout several tropical continents, *Euphorbia hirta L.* is used as an annual medicinal herb to treat a variety of illnesses, including infections the anti-fungal infections, gastrointestinal tract, pulmonary problems, wound healing, urinogenital disorders, malignancies, and breastfeeding in women (5,6).

Ethnopharmacological Study

Plant Description:

Taxonomy of plant:

Kingdom – Plantae.
Subkingdom – Viridaeplantae.
Division – Tracheophyta.
Subdivision – Spermatophytina.
Infradivision – Angiosperms.
Class – Magnoliopsida.
Superorder – Rosanae.
Order – Malpighiales.
Family – *Euphorbiaceae.*
Genus – *Euphorbia.*
Species – *hirta* (7,8)

Figure 1: Wild plant of *E.hirta*

Morphology

The plant is a common herb found in World Wide Australia, Northern Territory, Queens land, New South Wales, Central America, Africa, Indomalesia, Philippines, China and India *Euphorbia hirta* is usually grow up to height 40 cm tall. *Euphorbia hirta* is a slender- stemmed reddish and purplish color, with many branches from the base to summit (9). Covered with yellowish hair especially young parts. The leaves 1-1.5cm long is opposite, elliptic-long to oblong-lanceolate, unequal base, cuneate one side, round other side, dark green above, pale beneath, purple both in middle. when leaves were injured, they release a strong, aromatic minty scent. Flowers are unisexual male flowers are sessile linear, bracteoles, single stamen and perianth is absent. Female flowers are short pedicles, rimmed perianth superior ovary, covered with short hair. The fruits are yellow, three-celled, hairy, keeled capsules, 1 - 2 mm in diameter, containing three brown, four-sided, angular, wrinkled seeds (10).

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Histological Character

- Leaf: Leaf is dorsoventral and with uniformly thin lamina. It is 300µm thick and 390µm wide. The epidermal layer consists of fairly thick cylindrical thin-walled cell which are 10µm thick. Adaxial part of the xylem strand occurs on one of the dilated cells with dense chloroplast, there cells are called 'Krantz tissue' (11,12).
- Epidermal cell and Stomatal type: Epidermal cell are thin walled, the anticlinal walls are highly wave with deep folds so that this cell appear amoeboid in outline. Stomata occur only on the adaxial site of lamina that is hypostomatic they are anomocytic type and have no subsidiary cells. The guard cells are small and elliptical in shape they have wide stomatal pore (13,14).
- Venation pattern: The venation is densely reticulate, the major and minor veins are equally thick. The veins islets are wide rectangular or squares in outline. The veins boundaries are thick and distinct. The vein termination is either unbranched or branched twice or more. Single layer of Kranz cell forming thick sheath all around the veins (14).
- Petiole: It is semicircular and planoconvex in sectional view. It is 950µm wide and 750µm thick, has a thin less prominent epidermal layer of small cell. There is shallow arc of four vascular bundle with narrow gap in between (15).
- Powder microscopy: Powder characteristic revealed the presence of starch granules, scalariform vessels, covering trichomes, lignified trichomes, pericyclic fibers, epidermal cell with trichomes and Kranz tissues (16).
- Quantitative microscopy: Vein islet number, vein termination number, stomatal number, stomatal index (Table 1) (16,17).

Table 1: Quantitative evaluation of the crude drug of leaf of *Euphorbia hirta*.

Sr.no.	Standardization parameters	Inference
1	Vein islet no.	8 /sqmm
2	Vein termination no.	6 /sqmm
3	Stomatal no. (upper)	16.66
	Stomatal no. (Lower)	28.66
4	Stomatal index (upper)	6.319
	Stomatal index (Lower)	8.835

Traditional uses

The plant used as anti-inflammatory, antioxidant, antitumor, antidiabetic and free radical scavenging, anti-allergic, analgesic and antianaphylaxis, anxiolytic, sedative, antiarthritic, antidiarrheal, spasmogenic, anti-thrombocytopenic, diuretic, GI tract, burn wound healing, immune stimulatory, sperm motility, genotoxic, synergic, antiviral, anthelmintic, immunoprophylactic, antimalarial, antimicrobial, herbicidal, antimolluscidal, larvicidal property (18). In South India it is used as Eardrops in treatment of boils, score and wounds the plats are also eaten has vegetable. The latex of plant is often used as warts and cuts to prevent pathogenic infection (19). The decoction of leaves induces milk flow and leave chewed with palm kernel for restoration of virility (20). It is also effective in treating ulcer (21).

Pharmacological Action

- **Antidiabetic activity:** Significant antidiabetic action has been shown in studies on flavonoids extracted from *Euphorbia hirta*, especially in novel prenylated flavonoids, quercetin, 3'4'-dimethoxy quercetin, and hirta flavonoid B. The α-glucosidase enzyme, which lowers intestinal absorption of glucose and aids in regulating postprandial blood sugar levels, is strongly inhibited in vitro by these substances. These flavonoids improved lipid profiles, reduced blood glucose levels, and shown anti-inflammatory and antioxidant properties in rats with alloxan-induced diabetes. Additionally, histopathological investigations demonstrated that pancreatic β-cells were protected. These flavonoids may improve insulin sensitivity, trigger AMPK signalling, and lower inflammation and oxidative stress, providing a comprehensive strategy for diabetes management. Although more clinical research is required to validate their effectiveness, these findings show promise as natural treatment agents for diabetes (21).
- **Antiviral activity:** Herpes simplex virus (HSV), influenza, hepatitis B and C, and may be HIV are among the viral diseases that myricitrin, a flavonoid that was isolated using 50% ethanolic or methanolic solutions, has demonstrated encouraging antiviral qualities against. Inhibiting viral reproduction, preventing viral attachment and entrance into host cells, and modifying the immune response are the main mechanisms responsible for its antiviral action. Antioxidant qualities also seen in myricitrin aid in lowering oxidative stress during viral infections. Its effectiveness and low toxicity are demonstrated by in vitro and preliminary in vivo experiments (21).
- **Anti-inflammatory activity:** The terpenoid component, β-amyrin, and the ethanolic extract of *Euphorbia hirta* have notable anti-inflammatory properties, especially in the mouse model of TPA-induced ear inflammation. Prostaglandins and cytokines (TNF-α, IL-1β, and IL-6) are among the important pro-inflammatory mediators that β-amyrin suppresses by altering pathways such as NF-κB and COX enzymes. In addition, it has anti-inflammatory qualities because it scavenges free radicals and lowers oxidative stress, both of which contribute to its antioxidant activity (22).
- **Anticancer activity:** *Euphorbia hirta* possesses a variety of bioactive compounds with notable anticancer effects, including a newly identified cyclopentanone derivative found in the ethanolic extract, along with flavonoid glycosides such as afzelin, quercetin, and myricitrin extracted through methanol. The cyclopentanone derivative demonstrates cytotoxic properties by hindering the proliferation of cancer cells, triggering apoptosis, and diminishing metastasis. The flavonoid glycosides,

especially afzelin, quercetin, and myricitrin, exhibit strong anticancer effects against human epidermoid carcinoma by facilitating apoptosis, causing cell cycle arrest, and preventing tumor migration and angiogenesis. These compounds operate through diverse mechanisms, including the activation of caspases, the inhibition of crucial cancer-related proteins, and the reduction of oxidative stress, positioning *Euphorbia hirta* as a valuable candidate for anticancer drug innovation (21).

- **Antimicrobial activity:** The antimicrobial activity of *Euphorbia hirta* is primarily attributed to its bioactive compounds, including flavonoids, alkaloids, terpenoids, and saponins. These compounds exhibit strong activity against Gram-negative bacteria such as Salmonella typhi and Escherichia coli, which cause typhoid fever and urinary tract infections, respectively (22).
- **Allergic activity:** In experimental models, the 90% ethanolic extract of *Euphorbia hirta* has shown significant anti-allergic activity by inhibiting mast cell degranulation. During allergic reactions, mast cells release histamine and inflammatory mediators; by stabilizing these cells, *Euphorbia hirta* prevents the release of these substances, reducing allergic symptoms. The extract most likely acts through its bioactive compounds, such as flavonoids, saponins, triterpenoids, and alkaloids, which aid in modulating immune responses. This activity suggests that *Euphorbia hirta* could be useful in treating allergic conditions like asthma, rhinitis, and urticaria by supplementing conventional therapies (22).
- **Antiasthmatic activity:** By preventing histamine-induced bronchoconstriction in guinea pigs, paraxarol, a tri-terpene that was extracted from the ethanolic extract of *Euphorbia hirta* stems, has anti-asthmatic properties. Paraxarol reduces airway constriction, inflammation, and hyper-responsiveness by blocking the effects of histamine, a major mediator in asthma that promotes airway constriction. Because of its activity, paraxarol has the potential to be used as a therapeutic drug to manage asthma, reducing symptoms including wheeze and dyspnea (22).
- **Anti-snake venom:** Pyrogallol, a triphenolic molecule, and quercetin, a flavonoid, are both present in the methanolic extract of *Euphorbia hirta* and have both demonstrated strong anti-snake venom efficacy. The protease activity of Naja naja venom, which causes tissue damage and disrupts blood coagulation during envenomation, is inhibited by these substances. Pyrogallol and quercetin help stop the toxic consequences of venom. As a result, *Euphorbia hirta* is a potentially effective natural treatment for snake bites that may be used in conjunction with conventional antivenoms to treat envenomation (22).
- **Immunomodulatory activity:** Remarkable immunomodulatory action is demonstrated by the methanolic extract of *Euphorbia hirta*, which can both boost immune responses and reduce inflammation. By inducing immunological cells such as T-lymphocytes, B-lymphocytes, and macrophages, it strengthens the body defense system. Furthermore, the extract reduces inflammation by boosting phagocytic activity and blocking pro-inflammatory mediators. According to these results, *E. hirta* may help cure immune-related disorders such infections, autoimmune illnesses, and chronic inflammation (23).
- **Antifungal activity:** Remarkable antifungal behaviour is demonstrated by the methanolic extract of *Euphorbia hirta* leaves, flowers, stems, and roots, especially against yeast species with names like Candida albicans. By compromising the integrity of the cell membrane, interfering with vital metabolic functions, and blocking important enzymes, the extract prevents fungal development. Because of these characteristics, *E. hirta* shows promise as a natural treatment for fungal infections (22).
- **Antianxiety activity:** The hydro alcoholic extract of *Euphorbia hirta* aids in lowering stress and anxiety reactions. In order to promote serenity and relaxation, it probably modulates neurotransmitters like serotonin, GABA, and dopamine. It may also increase GABAergic activity. In animals, including those under long-term immobilization stress, the extract reduces anxiolytic behavioral and physiological manifestations. According to these findings, *E. hirta* may be a promising natural medication that can be used as a supplement or alternative for anxiety disorders and chronic stress (23).
- **Antiarthritic activity:** The water-soluble extract of *Euphorbia hirta* reduces joint inflammation and cartilage degradation in arthritis, showing good antiarthritic efficacy, even at modest dosages. Joint mobility is enhanced, pro-inflammatory mediators are inhibited, and cartilage is protected by the extract. With its potential to alleviate symptoms and enhance joint health, *E. hirta* may prove to be a valuable adjunctive treatment for osteoarthritis and rheumatoid arthritis (23).
- **Antimalarial activity:** *Euphorbia hirta* methanolic extract exhibits strong antimalarial activity. Plant extract prevent the Plasmodium parasite from growing, which lowers parasitemia and lessens the symptoms of malaria. The extract has potential as a supplemental therapy or natural alternative for malaria, especially in regions where antimalarial medication resistance is an issue (23).
- **Analgesic and antipyretic activity:** With notable analgesic and antipyretic properties, the lyophilized aqueous extract of *Euphorbia hirta* holds promise for the treatment of fever and pain. The extract successfully lowers yeast-induced hyperthermia in rats and mice. Its antipyretic effect is ascribed to its capacity to work on the hypothalamus to regulate body temperature, while its analgesic activity is probably caused by the inhibition of pro-inflammatory cytokines and prostaglandins, which are implicated in pain perception. This shows that *E. hirta* may be used as a supplementary or natural remedy for ailments like headaches, arthritis, and fever brought on by inflammation or infections (23).

Materials and Methods

Pharmacognostic Study

Organoleptic Properties of *E.hirta* Plant

Euphorbia hirta Linn has been extensively studied for its organoleptic properties; The organoleptic properties of the plant are important for determining its quality and potency.

Physico-Chemical Evaluation of *E.hirta* Plant

Loss on drying (LOD): A technique used to determine the moisture content of a substance. The process involves heating a sample until it's completely dry, measuring its weight before and after, and calculating the weight loss. This method can also measure the loss of other volatile components, such as alcohol or fat.

Ash value determination

Ash values are helpful to determine the quality as well as purity of a crude drug. Especially when drug is present in the powder form. The object of ashing crude drug is to remove the trace of organic matter may be interferes in an analytical determination (24).

Total ash value:

3g of powder was taken in a dried attired silica crucible and incinerated at a temperature not exceeding than 400^{o}C until free from carbon. The resultant ash was cooled and weighed.

Water soluble ash

3g of powder was boiled for 5min with 25 ml of water and the insoluble matter was collected on ashless filter paper. It was washed with hot water, ignited and weighed.

Acid insoluble ash

3g powder was boiled for 5 min with 25 ml of Dil. HCL and the insoluble matter collected on ashless filter paper. It was washed with hot water, ignited and weighted.

Alcohol soluble extract

4g of powder, add 100 ml of distilled water, shake occasionally for 6 hour and stand for 18 hours. Filter the solution and pipette out 25ml filtrate in 100 ml beaker and evaporate to dryness on water bath. (Keep it in oven at 105°C for 6 hours cool in desiccators for 30 min and weighted) (24).

Water soluble extract

4g of powder, add 100 ml of distilled water, shake occasionally for 6 hour and stand for 18 hours. Filter the solution and pipette out 25ml filtrate in 100 ml beaker and evaporate to dryness on water bath. (Keep it in oven at 105°C for 6 hours cool in desiccators for 30 min and weighted) (24).

Preliminary phytochemical testing of drug powder

The bioactivity of herbal constituents was evaluated based on the phytoconstituents they contain. The methanolic, and hydroalcoholic extracts of *Euphorbia hirta* foliage were subjected to screening procedures to verify the presence of phytoconstituents through various chemical assays in accordance with established protocols.

Method of Extraction

The aerial components of Euphorbia hirta were collected from local areas, subjected to thorough cleaning, and subsequently permitted to undergo desiccation in a shaded environment. Upon achieving complete dryness, a mechanical grinder was employed to reduce the plant material into a fine powder. A sterile conical flask was then filled with approximately 50 grams of the processed plant material. The extraction solvent, specifically 500 mL of methanol, was introduced while maintaining a weight-to-volume ratio of 1:10 by immersing the flask in an ultrasonic bath, the resultant mixture was subjected to sonication for a duration of 30 to 60 minutes at ambient temperature. The extraction of phytoconstituents was significantly enhanced by the ultrasonic waves, which facilitated the dissolution of plant cell walls. To eliminate any residual plant matter, the mixture was allowed to settle post-sonication, followed by the extraction being filtered through Whatman filter paper. The filtrate was concentrated utilizing a rotary evaporator under reduced pressure at temperatures ranging from 40 to 45°C to ensure the removal of methanol. The concentrated extract was subsequently dried to attain either a semi-solid or a dry mass. It was then stored in an airtight container at a temperature of 4°C for prospective application in gel formulation. Following sonication, the mixture was permitted to settle before being filtered through Whatman filter paper to eliminate any remaining plant residues.

Table 2: Formulation of Batches of Gel Formulation

Sr.No	Ingredients	F1	F2	F3	F4
1	Distilled water	3 ml.	3.5 ml.	5 ml.	5 ml.
2	Glycerine	2.0 gm.	2.5 gm.	1.5 gm.	2.0 gm.
3	Tea tree oil	0.5 gm.	0.4 gm.	0.3 gm.	0.3 gm.
4	Guar gum	1.5 gm.	0.8 gm.	1.2 gm.	1.0 gm.
5	Drug extract	1.2 gm.	1.8 gm.	1.5 gm.	1.5 gm.
6	Aloe Vera gel	q.s.	q.s.	q.s.	q.s. to 20.0 gm.
7	Reasons For Failure	Too viscous due to high Guar gum Leads to poor spreadability.	Excess glycerine leads to greasy texture and reduced aesthetics	High Aloe Vera and Guar gum leads to overly thick and stiff gel	Final Formulation

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Formulation of Gel

With constant stirring, 1.0g of Gaur gum was added to 5 mL of distilled water. After that, it was left for half an hour. In a beaker with hydrated guar gum, 1.5g of the *E. hirta* plants methanolic extract was added, and the mixture was gently stirred. It was well blended with 0.3g of tea tree oil. Aloe vera gel was weighed and its volume was adjusted to 20g moved the gel into a sterile container and kept it in dry and cool place (25, 26).

Evaluation of Gel

Clarity and Appearance

- Purpose: Colour, transparency, homogeneity, and the presence of any suspended particles.
- Procedure: Visually inspect the gel against a black and white background and in normal light was examined.

Measurement of pH

- Purpose: To obtained skin compatibility.
- Procedure: Weighed one gram of gel and dispersing it in ten millilitres of distilled water. Use a digital pH meter that has been calibrated to determine the pH.

Spreadability

- Purpose: To determine how simple it is to apply to the kin.
- Procedure:
  - Sandwich one gram of gel between two 20 x 20 cm glass plates.
  - For one minute, apply a given weight on the top plate.
  - Determine the spread circle's diameter.

Formula: $S = M \times L/T$

Where, S = Spreadability coefficient. M= Mass
L = Length moved on the glass slide. T = Time taken.

Figure 2: *E. hirta* topical gel

Figure 3: pH detection

Figure 4: Spreadability

Extrudability

Purpose: Determines the amount of force needed to remove gel from the tube.
Procedure: Involves filling a collapsible tube with gel. Measure the amount extruded in ten seconds after applying force to the crimped end.

Uniformity

Purpose: To obtain consistency and even dispersion of active ingredients. Procedure: Visually examine and handle small samples.

Skin Irritation Test (Patch Test)

- Purpose: To assess skin application safety.
- Procedure: Apply a tiny bit of gel to a 1 cm^2 section of three to five healthy volunteer forearms. Over a 24-hour period, keep an eye out for redness, itching, or inflammation.

Microbial assay

Table 3: Microbial assay

Sr.no	Microorganism	Result	Inference
1	*Aspergillus niger*	+	No growth
2	*Candida albicans*	+	No growth
3	*Streptococcus aureus*	+	No growth

Zone of Inhibition

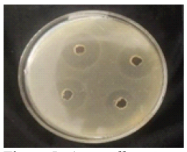

Figure 5: *Aspergillus niger*

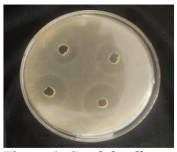

Figure 6: *Candida albicans*

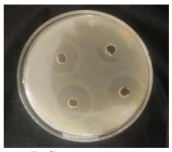

Figure 7: *Streptococcus aureus*

Results

Pharmacognostic study

Shade-dried leaves of the *E. hirta* plant were evaluated for organoleptic, microscopic, and physical characteristics. The organoleptic characteristics of the *E. hirta* plant are given in Table 4.

Table 4: Organoleptic characterestics of *E.hirta*

Organoleptic characters	Description
Color	Leaves: green with purplish undertones. Stems: Round, red stems with long, white hairs lining them.
Odor	Characteristic odor that is slightly pungent and bitter.
Texture	Hairy texture on its stems and leaves
Taste	Bitter and astringent, with a cooling effect.
Size	Leaf length (2-7 cm), leaf width (0.5-1 cm), flower size (0.5-1.5 cm).
Shape	Oblong, paired leaves have a sharp leaf border

Physicochemical Studies

The ash values, extractive values of powdered leaves were investigated. The information congregated from the previous studies is presented in Table 5. The physicochemical analysis performed in this study will help to identify plant adulteration with other species.

Table 5: Parameters of physicochemical studies

Sr.no.	Parameters	% value (w/w)
1	Loss on drying	14.14
2	Total ash value	12.66
3	Water-soluble ash value	10.26
4	Acid insoluble ash value	2.41
5	Sulphated ash value	14.21
6	Alcohol soluble extractive value	8.37
7	Water-soluble extractive value	8.55

(% w/w = Percent weight by weight)

Extraction Yield

The extraction yields of the *E. hirta* plant were quantified for methanolic, and hydroalcoholic extracts. The extraction yield was determined by employing the equation that relates the weight of the extract to the weight of the desiccated plant material. The hydroalcoholic extracts of the foliage demonstrated a superior yield (23.36 % w/w), followed closely by the methanolic extract (19.76 % w/w).

Phytochemical analysis

The phytochemical examination of the extracts was conducted according to a standard method delineated in the literature (Khandelwal, 2008). The findings of the phytochemical investigation are presented in Table 6. Phytocompounds were found to be predominantly concentrated in the methanol extract in comparison to the hydroalcoholic. Among the various phytocompounds, alkaloids, flavonoids, polyphenols, saponins, exhibited higher concentrations in the methanolic extract. The hydroalcoholic extract revealed the presence of amino acids, proteins, carbohydrates, polyphenols, and tannins.

Table 6: Phytochemical screening of *E. hirta*

Sr. No.	Phytoconstitue	Methanolic	Hydroalcoholic
1	Carbohydrates	-	+
2	Proteins	-	+
3	Amino acid	-	+
4	Alkaloids	+	-
5	Flavonoids	+	-
6	Saponin	+	-
7	Glycosides	-	-
8	Polyphenols	+	+
9	Sterols	-	-
10	Terpenoids	-	-
11	Tannins	-	+

(+) = Positive test; (-) = Negative test

Table 7: Evaluation Parameter of topicl gel

Sr.no	Evaluation parameter	Result
1	Clarity and Appearance	Clear
2	Measurement of pH	5.41
3	Spreadability	120 g.cm/s
4	Extrudability	Pass
5	Uniformity	Pass
6	Skin Irritation Test	Pass
7	Microbial assay	pass

Discussion

The study conducted a comprehensive analysis on ethnomedicinal, phytochemical, and physico-chemical properties of *Euphorbia hirta,* commonly referred to as Asthma Plant or Garden Spurge. The ethnopharmacological studies revealed that the *E. hirta* plant traditionally used as anti-inflammatory, antioxidant, antitumor, antidiabetic, anxiolytic, as well as its utility in various respiratory condition, expectorants and digestive problems. The plant powders under investigation exhibited a moisture loss of 14.14% w/w. This water content level is known to impede oxidation reactions and fermentation processes. The total ash content of the *E. hirta* powder was determined to be 12.66% w/w. The sulphated ash, water-soluble and alcohol-soluble ash values were noted as 14.21%, 10.26 % w/w and 2.41% w/w, respectively. Furthermore, the extractive values for both alcohol and water-soluble compounds were found to be 8.37%w/w and 8.55%w/w, respectively. The study delineates several active phytoconstituents present in *Euphorbia hirta*, including flavonoids, alkaloids, saponins, terpenoids, and tannins. These bioactive compounds are attributed to the diverse pharmacological effects exhibited by the plant. The gel formulation proved to be safe, stable, and effective for topical application. This research substantiates the medicinal potential of *Euphorbia hirta* and supports its integration into natural therapeutic products, encouraging further clinical studies and product development in phytopharmaceuticals.

Conclusion

The present study reviewed the botanical description, medicinal uses, active phytoconstituents and pharmacological activities of an invasive plant *E.hirta*. It has a wide and significant therapeutic activity. It is a popular herb among practitioners of traditional medicines in China and other countries. It has been used for treatment of various ailments in the form of decoction or infusion. It is used in intestinal disorders, diarrhea, amoebic dysentery, peptic ulcers, and asthma, bronchitis and skin diseases. The parts have various anti-inflammatory, antidiabetic, anti-tumor, antioxidant and antimicrobial properties. More research is being carried out to isolate and describe particular active constituents for various purposes. The gel formulation prepared for anti-inflammatory activity proved to be safe, stable, and effective for topical application. Further investigation is necessary to understand the relationship between phytochemicals and their activities through various analytical studies.

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