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Research Article

Phytochemical Characterization and In Vitro Anti-Inflammatory Evaluation of Ethanolic Extract of Jatropha Gossypiifolia Linn

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ABSTRACT

The present study aimed to characterize the ethanolic extract of Jatropha gossypiifolia and evaluate its in vitro anti-inflammatory activity. The extract was subjected to physicochemical analysis, phytochemical screening, solubility study, UV-visible spectroscopy, and calibration curve determination. The physicochemical parameters confirmed the quality of the crude drug, while phytochemical tests indicated the presence of alkaloids, flavonoids, tannins, and diterpenes. UV spectroscopic analysis showed a maximum absorption (λmax) at 204.8 nm. The anti-inflammatory activity was evaluated by the protein denaturation method using diclofenac sodium as the standard drug. The extract showed dose-dependent inhibition of protein denaturation, indicating significant anti-inflammatory potential. These findings suggest that Jatropha gossypiifolia Linn. is a promising natural source of bioactive compounds and may be useful for the development of herbal anti-inflammatory formulations.

INTRODUCTION

Medicinal plants have been widely used in traditional medicine because they contain natural compounds with important therapeutic properties. Many plant-derived phytochemicals possess anti-inflammatory, antioxidant, antimicrobial, and wound-healing activities, making them valuable sources for the development of herbal medicines (1). Among these medicinal plants, *Jatropha gossypiifolia* Linn., belonging to the family Euphorbiaceae, has been extensively used in folk medicine for the treatment of inflammation, skin diseases, wounds, fever, and infections (2).

The plant contains several bioactive constituents such as alkaloids, flavonoids, tannins, glycosides, diterpenes, and phenolic compounds, which

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contribute to its pharmacological activities (3). Flavonoids and phenolic compounds are particularly known for their ability to inhibit inflammatory mediators and reduce oxidative stress, thereby helping to control inflammation (4).

Standardization and characterization of herbal extracts are important to ensure their quality, purity, and reproducibility. Physicochemical parameters, phytochemical screening, UV-visible spectroscopy, and other analytical methods provide valuable information regarding the identity and chemical composition of medicinal plants (5,6).

Inflammation is a protective response of the body against tissue injury; however, prolonged inflammation may lead to chronic diseases. The protein denaturation assay is a simple and reliable in vitro method for evaluating anti-inflammatory activity because denatured proteins are associated with inflammatory disorders (7). Therefore, the present study was undertaken to characterize the ethanolic extract of *Jatropha gossypiifolia* Linn. and evaluate its anti-inflammatory potential using the protein denaturation method.

Materials and Methods

Fresh leaves of *Jatropha gossypiifolia* Linn. were collected, authenticated, shade dried, powdered, and extracted using ethanol by a suitable extraction method. The obtained extract was subjected to physicochemical evaluation, including determination of total ash value, acid-insoluble ash, extractive value, and moisture content according to standard pharmacopoeial procedures (8). Preliminary phytochemical screening was carried out to identify alkaloids, flavonoids, tannins, glycosides, and diterpenes using standard qualitative tests (9).

The extract was further evaluated for solubility in different solvents. UV-visible spectroscopic analysis was performed by preparing the extract solution in ethanol, and the maximum absorption wavelength (λmax) was determined. A calibration curve was prepared following Beer–Lambert's law for quantitative estimation (10).

The in vitro anti-inflammatory activity was assessed using the protein denaturation method. Different concentrations of the extract were incubated with egg albumin and heated under controlled conditions. Diclofenac sodium was used as the reference standard. The absorbance was measured spectrophotometrically, and the percentage inhibition of protein denaturation and IC50 values were calculated. All experiments were performed in triplicate, and the results were expressed as mean values (11).

Results and discussion:

Result of Physicochemical Parameter andi t's Evolution:

Table no.1 Physical Content of *Jatropha gossypiifolia Linn.*

Sr.No.	Physicalconstant	Percentage
1.	Total Ash Value	**33.5%**
2.	Acid Soluble Ash Value	**23.5%**
3.	**Alcoholic Soluble ExtensiveValue**	**74%**

Table no.2 Determination of Moisture content of *Jatropha gossypiifolia Linn.*

Sr.No.	Method	Percentage
1.	Moisture Content (loss of drying)	**7.62%**

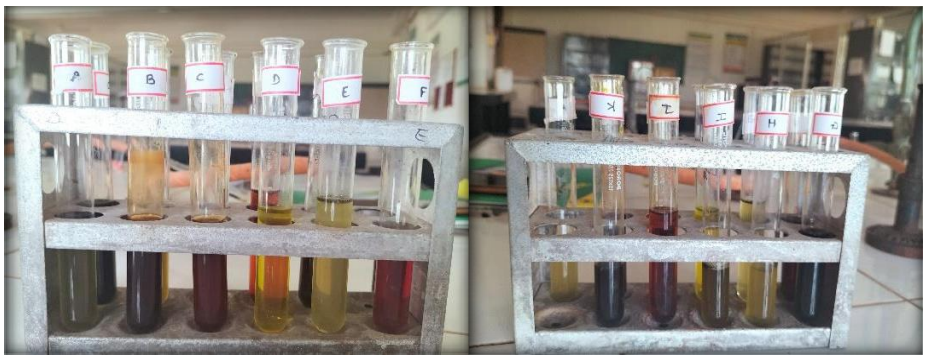

Fig.no.1 Chemical InorganicTest for Ethanolic Extract of *Jatropha Gossypiifolia Linn.*

Table no.3 Results of Identification properties of Ethanolic extract*of Jatropha gossypiifolia Linn.* Plant.

SR.NO	CHEMICALTEST	OBSERVATION	INFERENCE
1	**TESTSFOR ALKALOIDS** **A) Mayers test:** Test solution treated with Mayer's reagent (potassium mercuric iodide)	Test shows cream colored precipitate	**Alkaloidsare present**
	B) Dragendorff's test: **Test solution treated with** Dragendorff reagent (potassium bismuth iodide solution)	Test shows reddish colored precipitate	**Alkaloidsare present**
	C) Wagener'stest: Test solution treated with Wagener's reagent (iodine potassium iodide solution)	Test shows brown colored precipitate	**Alkaloidsare present**
	D)Hager'stest: TestsolutiontreatedwithHager's reagent (picric acid).	Test shows yellow colored precipitate	**Alkaloidsare present**

2	**Test For Flavonoids** **a) Alkaline Reagent Test:** To the test solution few drops of sodium hydroxide solution were added.	Intense yellow colour was not formed which turns to colourless on addition of few drops of diluted acid indicate presence of flavonoids.	**Flavonoidsare present**
	b) Zinc hydrochloride test: To the test solution mixture of Zinc dust and conc. HCL were added.	It not gives red colour after few minutes.	**Flavonoidsare present**
	Tests For Tannins **(Phenolic Compounds)** **a) 5% Ferric Chloride Test:** The extract was treated with ferric chloride solution.	Greencolour disappeared	**Tanninsare present**
3	**b) Gelatin test:** To the test solution1% sodium chloride was added.	Precipitatewas formed	**Tanninsare present**
	c) AceticAcid: To thetest solution acetic acid solution were added.	Precipitate was formed	**Tanninsare present**
4	**Detection of glycosides** **a) Keller killani Test: :** Extracts were treated with Ferric Chloride solution were added and boiling.	Formation of rose-pink colour	**Anthranolglycosidesare absent**
5	**Detection of diterpenes** **a) Copper acetate Test:** Extracts were dissolved	Green colour indicates	**Diterpenesare Present**

	in water and treated with copper acetate solution		

Table no.4 Results of chemical tests for detection of inorganic constituents of ethanolic extract of *Jatropha gossypiifolia Linn.* Plant.

Sr.No.	CHEMICALTEST	OBSERVATION	INFERENCE
1.	**TESTS FOR CALCIUM:** To 10mL of filtrate1 drop of dilute NH4OH and saturated ammonium oxalate solution were added	Nob white ppt.is observed.	**Calciumare absent**
2.	**TESTS FOR SODIUM:** **a) Flame Test:** Thick paste of ash of drug with conc. HCL were prepared, Paste taken on the wire loop and Introduced in Bunsen flame.	Goldenyellowflame observed	**Sodium are present**
3.	**TESTSFOR POTASSIUM:** **a)** To 2-3 mL of test solution few drops of sodium cobalt nitrite solution were added. **b) FlameTest**	Yellow ppt. of potassium cobalt nitrite solution observed. Violet colour observed	**Potassium are present** **Potassium are present**
4.	**TESTS FOR IRON:** **a)** To 5 mL test solution few drops of 2% potassium Ferrocyanide were added. **b)** To 5mL test solution few drops of 5% ammonium thiocynate were added.	No colouration is observed. Solution turns black.	**Ironare absent** **Ironare absent**

5.	**TESTSFOR SULPHATE:** To test solution few drops of lead acetate reagent were added.	White ppt. was observed and which is soluble in NaOH	**Sulphateare present**

The Results for Qualitative Chemical Investigation of alcoholic extract of *Jatropha gossypiifolia Linn.* Indicated the presence of mainly.

Organic constituents:

Alkaloids, Flavonoids, Tannins. Glycosides. Diterpenes.

Inorganic constituents:

Sodium, Potassium, Chloride, Sulphate.

Solubility:

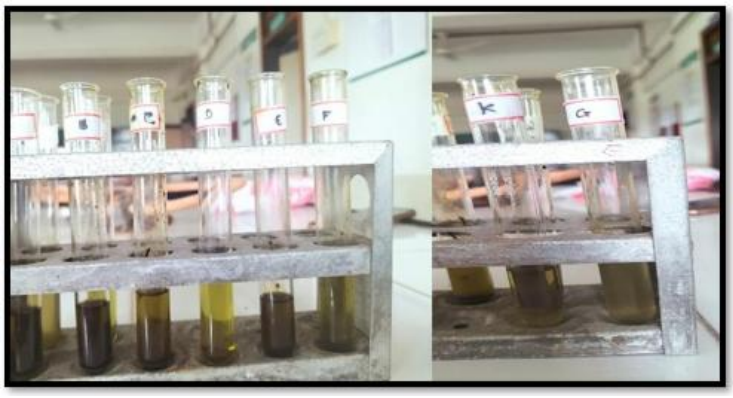

Figure No 2. The extract was analysed for solubility in different solvent

Table no.5. Solubility of *Jatropha gossypiifoliaL.* In Different Solvent

Solvent	Solubility
Methanol	+
Acetone	-
Butanol	+
Ethanol	+
Toluene	+
Ethyl acetate	+
Distilledwater	-
Aceticacid	+

Whereas, (+) indicate sign soluble and (-) indicate sign insoluble.

Determination of λmax:

The Extract solution 100 µg/ml in ethanol was prepared and analyzed at 200 to 800nmin UV spectrometer against ethanol as blank solution. The λmax extract solution was found to be at 204.8nm.

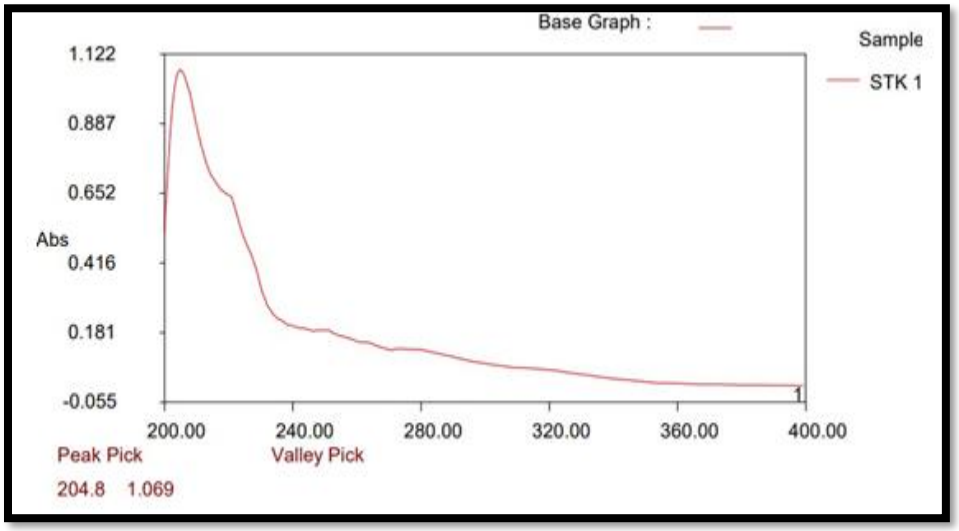

Figure No.3 UV λ max Graph of Ethanolic Extract of *Jatropha gossypiifolia L.*

Table no 6. Absorbance of Extract at different concentration

Sr. No.	Concentration (µg/mL)	Absorbance
1.	1 µg/mL	0.160
2.	2 µg/mL	0.246
3.	3 µg/mL	0.368
4.	4 µg/mL	0.524
5.	5 µg/mL	0.673

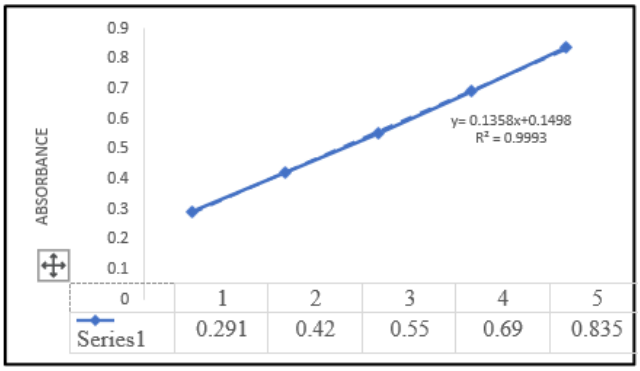

Figure no 4 UV-visible spectra of Alcoholic extract of *jatropha gossypiifolia L.*

In Vitro Anti-inflammatory Activity (Protein Denaturation Method):

The anti-inflammatory activity of Jatropha gossypiifolia Linn. extract was evaluated using the protein denaturation method. The extract showed dose-dependent inhibition of protein denaturation, with 65.3% inhibition at 100 µg/mL and 68.6% inhibition at 300 µg/mL. The results indicate that the extract possesses significant anti-inflammatory activity, although it was lower than the standard drug, diclofenac sodium. The increased inhibition at higher concentrations suggests that the extract contains bioactive compounds capable of reducing protein denaturation, which is associated with inflammatory responses. These findings support the potential use of Jatropha gossypiifolia Linn. extract as a natural anti-inflammatory agent.

Table No. 7. Result of Protein Inhibition Study

Sr. No.	Concentration (µg/ml)	Percentage Inhibition	
		Extract	Diclofenac(Std)
1.	100	65.3%	95.08%
2.	200	67.5%	95.88%
3.	300	68.6%	96.08%

Table No. 8 Result of IC50 value for Protein Inhibition study

Sr.No.	Compounds	IC50
1.	Standard	196.9549
2.	Extract	189.2083

CONCLUSION

The present study successfully evaluated the physicochemical properties, phytochemical constituents, and in vitro anti-inflammatory activity of the ethanolic extract of *Jatropha gossypiifolia* Linn. The extract exhibited acceptable physicochemical characteristics and contained important bioactive compounds such as

alkaloids, flavonoids, tannins, and diterpenes. UV-visible spectroscopic analysis confirmed the characteristic absorption of the extract and supported its identification. The protein denaturation assay demonstrated dose-dependent anti-inflammatory activity, indicating the ability of the extract to inhibit protein denaturation associated with inflammatory conditions. Although its activity was lower than that of diclofenac sodium, the extract showed promising biological potential as a natural anti-inflammatory agent. Overall, the findings support the traditional medicinal use of *Jatropha gossypiifolia* Linn. and suggest that it could serve as a valuable source for the development of herbal anti-inflammatory formulations. Further phytochemical isolation, toxicity studies, and clinical investigations are recommended to establish its therapeutic efficacy and safety.

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