



Phytochemical and Anti-Inflammatory Activity of *Jatropha multifida* L.: A Review

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Abstract

Inflammation is the body's physiological response to infection and injury. Inflammation maintains tissue homeostasis under various hazardous conditions. This review article aims to provide the latest knowledge about the chemical composition and anti-inflammatory activity of *Jatropha multifida* L. Literature is taken from various online journals search sites such as Google Scholar, PubMed, and Science Direct, which have been published since 2012-2022. Based on 9 articles used, 7 discussed phytochemicals, and 4 discussed anti-inflammatory activity. *Jatropha multifida* L. contains alkaloids, flavonoids, tannins, saponins, steroids, phenols, and terpenoids, which have anti-inflammatory activity by reducing the volume of edema and the number of PMN leukocytes. This review shows that *Jatropha multifida* L. has the potential as a natural anti-inflammatory.

Keywords: Anti-Inflammatory, *Jatropha multifida* L., Phytochemical

1. Introduction

Inflammation is a protective response from the microcirculation initiated after infection and injury. Local and systemic inflammatory responses both aim to remove the triggering stimulus, enhance tissue repair and healing and, in the case of infection, build immune memory such that it can mount a more rapid and more specific response at future encounters (Fullerton & Gilroy, 2016).

Various pathogenic factors, such as infection, tissue injury, or cardiac injury, can induce inflammation by causing tissue damage. In response to tissue injury, the body initiates chemical response-stimulating agents aimed at healing the affected tissue. These signals activate leukocyte chemotaxis from the general circulation to the site of damage. These activated leukocytes produce cytokines that induce an inflammatory response (Chen et al., 2018).

In people's lives, many still use traditional medicines as an alternative to assist in healing therapy for a disease. Several types of alternative medicine are more dominant in using herbal plants as the main ingredient in the treatment of certain diseases. The plants used are usually often found in everyday life, and some are difficult to find in everyday life because the habitat for these plants is very difficult to find (Victorien et al., 2012).



Jatropha comes from the Greek word "*jatros*" which means doctor, and "*trophy*," which means food, which in its sense implies medicine. *Jatropha* genus belongs to the family of *Euphorbiaceae* and the ethnic group *Joannesieae* which has about 170 species. *Jatropha multifida* L. plant is found in tropical areas, such as Asia, South Africa, and Latin America. This plant is used in traditional medicine to cure various ailments (Rampadarath *et al.*, 2014a; Thomas, 2016).

Jatropha multifida L., or the iodine plant, has another name, namely *betadin*, *jarak cina*, or *jarak tintir*. *Jatropha multifida* L. is a herbal plant that can be used as a traditional medicine because it has many properties. The parts of this plant that can be used are the leaves, sap, stem, and seed oil used to treat infections in open wounds, dental caries, and various skin inflammatory conditions (Sudigdoadi *et al.*, 2019).

Therefore, the purpose of conducting a review on *Jatropha multifida* L. is to determine the anti-inflammatory activity and the content of chemical compounds from *Jatropha multifida* L. plants.

2. Data Collection

The method that the authors used in this review is a literature review study. A literature search is carried out in a structured manner to obtain the latest discussion and is relevant to the purpose of the review. Literature is taken from various online journal search sites such as Google Scholar, PubMed, and Science Direct, which have been published since 2012-2022. The keywords used in the search are *Anti-Inflammatory*, *Jatropha multifida* L., and *Phytochemical*. The selection of literature in this review is original articles or research articles published in Indonesian and English. This review does not include books, review articles, systematic reviews, meta-analyses, brief communications, bulletins, or expert opinions. Complete articles were collected, checked, summarized, and concluded.

3. Result and Discussion

A literature study on the phytochemicals and anti-inflammatory activity of *Jatropha multifida* L. used 9 articles, of which 7 articles discussed phytochemicals and 4 articles discussed the anti-inflammatory activity of *Jatropha multifida* L.

Phytochemicals

Rampadarath *et al.* performed phytochemical screening on leaves of *Jatropha multifida* L. by carrying out qualitative tests and quantitative tests. In the qualitative test, phytochemical screening was carried out using a test tube with alkaloids, flavonoids, tannins, steroids, and phenol compounds. Crude solvent extracts were used to test for phenols, and flavonoids were determined by TLC and UV techniques. *Retention factor* (Rf) on *Jatropha multifida* L. value for flavonoids with methanol extract was (0.42) and for phenol with methanol extract and ethyl acetate obtained a value of (0.72-0.74). Quantitative tests with total phenolic content (TPC) and total flavonoid content (TFC) on *Jatropha multifida* L. using methanol extract obtained a value of (7.70 ± 0.19) μg QE/g whereas, with ethyl acetate extract, there was none (Rampadarath *et al.*, 2014a).

Rampadarath *et al.* performed phytochemical screening on leaves of *Jatropha multifida* L. with qualitative and quantitative tests. A qualitative test using a test tube on the

ethyl acetate extract of leaves *Jatropha multifida* L. showed alkaloids, phenols, steroids, and tannins, whereas on the methanol extract of the leaves of *Jatropha multifida* L., the test showed alkaloids, flavanoids, phenols, and steroids. Phytochemical screening by thin-layer chromatography (TLC) showed the presence of alkaloids, flavonoids, steroids, tannins, and phenols in the methanol and ethyl acetate extracts. The retention factor (Rf) value was 0.42 for the methanol extract, indicating the presence of flavonoid glycoside compounds. Methanol extract and ethyl acetate Rf values obtained were 0.72 and 0.74 for phenol screening. The quantitative test revealed that the total phenol content (TPC) was higher than the total flavonoid content (TFC) and the methanol extract of the leaves. *Jatropha multifida* L. produces total phenol ($260.67 \pm 51.94 \mu\text{g GAE/g}$) and total flavonoids ($7.70 \pm 0.19 \mu\text{g QE/g}$) (Rampadarath *et al.*, 2014b).

Research was conducted by Carvalho *et al.* to determine the content of flavonoids and phenols contained in leaf and latex extracts of *Jatropha multifida* L. by the method of total flavonoid content (TFC) and total phenol content (TPC). The results obtained for total flavonoids with hydroalcoholic extracts were 2.322%, while for latex, it was zero. And the yield of total phenol for the hydroalcoholic extract is 0.130%, while the latex is 4.808% (de Carvalho *et al.*, 2018).

Anani *et al.* conducted research to determine the total phenolic content in leaf extracts of *Jatropha multifida* L. using the method of total phenolic content (TPC). The total phenolic content was determined using folin-ciocalteu and gallic acid as standard. The total phenolic content obtained from these tests was $1.09 \pm 0.26 \text{ mg GAE/g}$ (Anani *et al.*, 2016).

In research conducted by Franyoto *et al.*, quantitative phytochemical analysis was carried out on the stem ethanol extract of *Jatropha multifida* L. The research showed the presence of terpenoids, tannins, saponins, flavonoids, phenolics, and alkaloids. The aluminum trichloride method used rutin as a comparator to determine the total flavonoid content. In this study, the total flavonoid content (TFC) in stems *Jatropha multifida* L. is 18.6067 ± 0.041 (Franyoto *et al.*, 2018).

Falodun *et al.* conducted a phytochemical test on the methanol extract of the stem bark of *Jatropha multifida* L. The research produced three compounds, including the macrocyclic diterpenoid lathyrane, multifidone, and multifidinol, which were formed by 1D and 2D NMR experiments. The three diterpenoid compounds are known to have a lathyrane nucleus (Falodun *et al.*, 2014).

Falodun *et al.* performed phytochemical screening on the root bark of *Jatropha multifida* L. These tests found alkaloid compounds, tannins, saponins, and flavonoids in the root bark of *Jatropha multifida* L. (Falodun *et al.*, 2013).

Table 1. Summary on phytochemical of *Jatropha multifida* L.

Compounds	Parts	Country	References
Alkaloids, flavonoids, steroids, tannins, phenols	Leaves	Mauritius	(Rampadarath <i>et al.</i> , 2014a)
Alkaloids, flavonoids, steroids, tannins, phenols	Leaves	Mauritius	(Rampadarath <i>et al.</i> , 2014b)

Phenols, flavonoids	Leaves	Brazil	(de Carvalho <i>et al.</i> , 2018)
Phenols	Leaves	Togo, Afrika	(Anani <i>et al.</i> , 2016)
Terpenoids, tannins, saponins, flavonoids, phenols, alkaloids	Stems	Indonesia	(Franyoto <i>et al.</i> , 2018)
Macrocyclic lathyrane diterpenoid, multifidone dan multifidinol	stem barks	Nigeria	(Falodun <i>et al.</i> , 2014)
Alkaloids, tannins, saponins, flavonoids	Root barks	Nigeria	(Falodun <i>et al.</i> , 2013)

Anti-Inflammatory

In vivo

Anani *et al.* conducted a study on anti-inflammatory activity using the method of carrageenan and histamine-induced leg edema in the legs of adult Wistar rats divided into four groups of six each. Each group consists of three males and three females. The first and second groups received orally 200 and 400 mg/kg BW of *Jatropha multifida* L. leaf extract, respectively. The third group was given isotonic saline (9% NaCl), and the fourth group was given aspirin 1% ml/kg (control). The maximum anti-inflammatory effect occurred at 3 hours and 5 hours after administration of histamine and carrageenan. *Jatropha multifida* L. showed varying degrees of inhibition of edema. Carrageenan-induced inflammation showed significant anti-edema activity with doses (200 mg/kg and 400 mg/kg) at 2 hours and 5 hours. The percentage of inhibition is 31.57%, 52.05% for a dose of 200mg/kg, and 40.35%; 53.42% for a dose of 400mg/kg. Significant inhibition of histamine-induced leg edema at doses of 200 mg/kg and 400 mg/kg occurred 2 and 3 hours after induction. For a dose of 200 mg/kg at 2 and 3 hours, the values were 16.66% and 30.61%. At 3 hours, the values for the respective doses were 30.61% and 74.96%. This research shows that *Jatropha multifida* L. has anti-inflammatory activity, which can be seen by decreasing the volume of edema (Anani *et al.*, 2016).

Juniarti *et al* investigated the anti-inflammatory activity of *jatropha multifida* L. by looking at the number of PMN leukocytes by giving wounds to Spraque Dawley rats. 36 male rats were divided into four groups. Group 1 served as a negative control, group 2 (positive control) was given bethasone-N, group 3 (solvent control) was given 70% methanol extract, and group 4 was given methanol *Jatropha multifida* L. leaf extract of 10 mg dissolved in 70% methanol. On day 3 (inflammatory phase), the group which was given leaf extract of *Jatropha multifida* L. showed the lowest number of PMN leukocytes, followed by solvent control, positive control, and negative control. On day 6 (proliferation phase), the number of PMN leukocytes decreased in the extract treatment group and the negative control group, while the positive control and solvent groups showed the opposite effect. On day 13 (remodeling phase), PMN leukocytes decreased in all groups, different from days 3 and 6. *Jatropha multifida* L. showed the lowest number, followed by the solvent control group,

positive control, and negative control. In the inflammatory phase, which is represented by day 3 in this study, pro-inflammatory PMN leukocytes migrate to the wound area via chemotaxis. The infiltration of neutrophils, macrophages, and lymphocytes characterizes this process. The main function of PMN leukocytes at this stage is to minimize bacterial contamination of the wound. Macrophages have multiple roles in wound healing (Juniarti *et al.*, 2013).

Marzouk *et al.* reported the activity of acute anti-inflammatory effects of aqueous methanol extract tested by dividing rats into four groups. After 0.5 hours, the foot edema was induced by a subplantar injection of 0.1 mL of 1% sterile carrageenan solution in saline into the right hind leg pad. The left leg was injected with 0.5 mL saline. Leg volume was determined immediately before carrageenan injection and after 1, 2, 3, and 4 hours using a plethysmometer, and edema was expressed as a percentage change from control values. Showed that the induction of inflammation (edema and erythema) by carrageenan was time-dependent, and the volume of the legs reached a maximum after 4 hours. The two dose levels resulted in significant anti-inflammatory activity after 1, 2, 3, and 4 hours, and the percentage inhibition reached a maximum after 4 hours compared to indomethacin (Marzouk *et al.*, 2012).

Falodun *et al.* conducted research on the anti-inflammatory activity of root bark methanol extract of *Jatropha multifida* L. on carrageenan-induced leg edema. Wistar albino rats were divided into five groups consisting of five rats. Each animal in group 1 was given distilled water orally (control). Animals in groups 2,3, and 4 were respectively given 100 mg/kg, 200 mg/kg, and 400 mg/kg BW of root bark methanol extract of *Jatropha multifida* L. while group 5 was given indomethacin (10 mg/kg BW). Carrageenan-induced foot edema with root bark methanol extract of *Jatropha multifida* L. at a dose of 400 mg/kg BW showed a significant anti-inflammatory effect ($P < 0.01$) inhibiting leg edema within 3 hours after the inflammatory response, compared to control (Indomethacin) which showed that the extract could inhibit histamine, prostaglandin, and other inflammatory mediators because it maintains an anti-inflammatory effect in all phases of the inflammatory process. So it can be concluded that *Jatropha multifida* L. has significant anti-inflammatory activity (Falodun *et al.*, 2013).

Table 2. Summary of anti-inflammatory properties of *Jatropha multifida* L. (In vivo studies)

Type of extract/ Formulation	Plant part used	Dose/ Concentration	Experimental model	Animal	Pharmacological effects (Reported activity)	Country	Referesi
<i>Jatropha multifida</i> L. leaves extract	Leaves	200 and 400 mg/kg BW	Carrageenan-induced paw edema	Wistar rats	<i>Jatropha multifida</i> L. leaves extract has an anti-inflammatory effect in carrageenan-induced paw edema essay in rats, characterized by reducing edema.	Togo, Afrika barat	(Anani <i>et al.</i> , 2016)

Methanol extract	Leaves	10, 20, and 40 mg/kg BW	Wound creation	Sprague dawley rats	Methanol extract of <i>Jatropha multifida</i> L. showed the lowest number of PMN leukocytes	Indonesia	(Juniarti <i>et al.</i> , 2013)
Aqueous methanol extract	Leaves	subplanter injection of 0.1 mL of 1% sterile carrageenan solution and 0.5 mL of saline	Carrageenan-Induced Paw Edema in Rats	Rats	Aqueous methanol extract of <i>Jatropha multifida</i> L. has an anti-inflammatory effect in carrageenan-induced paw edema essay in rats, characterized by reducing edema.	Saudi Arabia	(Marzouk <i>et al.</i> , 2012)
Methanol extract	Root barks	100, 200, and 400mg/kg BW	Carrageenan-induced paw edema	Wistar albino rats	Methanol extract has an anti-inflammatory effect in carrageenan-induced paw edema essay in rats, characterized by reducing edema	Nigeria	(Falodun <i>et al.</i> , 2013)

4. Conclusions

Jatropha multifida L. has many benefits in the community as traditional medicine. The study of the chemical components of *Jatropha multifida* L. has shown that all parts of the plant contain many active substances, such as alkaloids, flavonoids, phenols, tannins, steroids, saponins, and terpenoids. *Jatropha multifida* L. plays a role in anti-inflammatory activity. Several studies conducted *in vivo* reported that *Jatropha multifida* L. could reduce the volume of edema and reduce the number of PMN leukocytes. It is confirmed that *Jatropha multifida* L. has the potential as an anti-inflammatory.

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