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Potential of Jatropha Curcas Seed Extract Linimentum as A Therapeutic for Scabies in Goats

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ABSTRACT. This study aimed to evaluate the potential of Jatropha curcas seed extract liniment (JSE) as a therapeutic agent for scabies in goats. The experiment involved 20 adult goats (12–15 months old) divided into five treatment groups: P0 (negative control), P1 (positive control), P2 (10% JSE), P3 (20% JSE), and P4 (40% JSE). Each treatment group consisted of four replicates, with one goat per replicate. The JSE preparation was applied topically to the affected skin twice daily (morning and evening) for 14 days. Data were collected on days 0, 3, 7, 10, and 14, assessing clinical parameters such as alopecia, skin thickening, scab formation, and scabies recovery time. The results indicated that the 40% JSE treatment (P4) exhibited superior efficacy compared to lower concentrations, yielding outcomes comparable to the positive control (ppt sulfur liniment), a widely used scabies treatment.

Keywords: goat, jatropha curcas, linimentum, medicine, scabies

INTRODUCTION

Parasitic diseases are a major factor affecting livestock productivity. In goats, one of the most prevalent parasitic diseases is mange, commonly known as scabies. Scabies in goats is caused by the infestation of *Sarcoptes scabiei var. caprae* mites. Infected goats exhibit symptoms such as severe itching, followed by blister formation, particularly on the face and back, which rapidly spreads across the body (Sawitri and Yuningsih, 2020). The Sarcoptes scabiei life cycle progresses through several stages, including egg, larva, nymph, and adult, with young adult females eventually reaching sexual maturity (Mursyid et al., 2022).

Scabies transmission primarily occurs through direct contact between infected and healthy livestock, including both domestic and wild animals. Sarcoptes mites feed by piercing the epidermal layer and consuming lymph fluid and young epidermal tissue cells. This leads to persistent itching, causing affected animals to scratch and rub their bodies, resulting in skin abrasions and worsening lesions (Hussain et al., 2021). Initially, infected skin develops erythema, progressing to papule and vesicle formation, followed by inflammation and exudate production. Over time, exudate accumulates and forms scabs. The prolonged infection process triggers keratinization and excessive proliferation of connective tissue, leading to skin thickening, wrinkling, and eventual hair loss over large areas of the body (Osti et al., 2022).

Various methods exist for controlling scabies, including the use of commercial acaricides, which can be applied through spraying or injection. However, the high cost and limited availability of these medications, especially in rural areas, pose significant challenges for small-scale farmers. As a result, traditional herbal treatments have gained popularity as a more accessible and cost-effective alternative (Sawitri and Yuningsih, 2020). Conventional scabies treatments, such as ivermectin, asuntol, and neguvon, are often expensive and difficult to obtain. Furthermore, cases of S. scabiei resistance to these drugs, both in vitro and in vivo, have been reported (Rosumeck et al., 2018). Therefore, alternative scabies treatments that are more affordable, accessible, and effective are urgently needed.

With advancements in science and technology, medicinal plants have become a promising source for developing both chemical and traditional therapeutic compounds. The bioactive compounds found in plants play a crucial role in their medicinal properties, often exhibiting fewer side effects than synthetic drugs (Nega et al., 2022). One such plant with medicinal potential is Jatropha curcas, which has been traditionally used by various ethnic groups in Indonesia for its therapeutic properties. Phytochemical analyses have identified numerous bioactive compounds in Jatropha curcas, including coumarins, alkaloids, cardiac glycosides, flavonoids, saponins, steroids, tannins, terpenoids, phenols, quinones, and oxalates (Wu and Zhang, 2020).

Coumarins, a class of benzopyrone compounds found in Jatropha curcas, exhibit various biological activities, including antimicrobial, antiviral, anti-inflammatory, antidiabetic, antioxidant, and enzyme-inhibitory

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effects. Additionally, coumarins have been reported to disrupt mitochondrial function in insect nervous and muscular systems in vitro, suggesting their potential as a natural insecticide (Sawitri and Yuningsih, 2020). Secondary metabolites present in Jatropha curcas leaf extracts, such as alkaloids, saponins, tannins, terpenoids, steroids, glycosides, phenols, and flavonoids, further enhance its medicinal value (Rahman et al., 2023).

Given its rich bioactive composition, Jatropha curcas holds promise as an alternative treatment for various dermatological conditions, including dermatitis, pruritus, insect-borne infections, rheumatism, wound healing, and scabies. This study aims to explore the potential of Jatropha curcas seed extract liniment as a therapeutic agent for scabies in goats, offering a natural, cost-effective alternative to conventional treatments.

MATERIALS AND METHODS

This study utilized 20 adult goats, aged 12-15 months, with a body weight range of 25-30 kg. The goats were selected based on the presence of clinical symptoms indicative of scabies, including frequent rubbing against objects such as cages or tree trunks, hair loss, and the presence of skin lesions accompanied by thickening and scabs. Skin scrapings were collected and examined under a microscope to identify Sarcoptes scabiei, confirming scabies infection. Goats diagnosed with scabies were then randomly assigned to one of five treatment groups.

Prior to the experiment, the goats were housed in stage cages and underwent a two-week adaptation period. During this period, they were administered worming medication. Each goat was fed 500 g of concentrate per head per day (distributed in the morning and evening), with ad libitum access to grass.

The experimental treatments were as follows:

P0= Negative control (Linimentum oleum coccos)
P1= Positive control (Linimentum sulfur ppt)
P2= 10% Jatropha curcas seed extract linimentum
P3= 20% Jatropha curcas seed extract linimentum
P4= 40% Jatropha curcas seed extract linimentum

Preparation of Jatropha Curcas Seed Extract and Linimentum

Jatropha curcas seeds were sourced from Majene Regency. The seeds were cleaned using running water and then dried at temperatures between 45-55ºC. Once dried, the seeds were ground into a fine powder using a blender and sieved. The seed extract was prepared through sonication in a 70% ethanol solvent. Specifically, 100 g of the powdered seed material (simplisia) was combined with 400 mL of ethanol (1:4 ratio, w/v). Sonication was performed at a frequency of 50 kHz for 1 hour. After sonication, the mixture was filtered, and the liquid extract was concentrated using a rotary evaporator at 49 ºC, 20 rpm, and 176 mBar pressure until a thick extract was obtained (Rizkia et al., 2022). To prepare the linimentum, sterile oleum coccos was added to the Jatropha curcas seed extract according to the designated treatment concentrations: P2: 10 ml extract + 90 ml oleum coccos, P3: 20 ml extract + 80 ml oleum coccos, P4: 40 ml extract + 60 ml oleum coccos. The mixture was stirred thoroughly until it formed a homogeneous linimentum preparation.

Administration of Jatropha Curcas Seed Extract Linimentum

Before treatment, the affected areas of goat skin showing symptoms of scabies were shaved. The linimentum was then applied topically to the affected skin areas for 14 consecutive days, with applications occurring twice daily (morning and evening). Skin changes during the treatment period were monitored, recorded, and documented.

Data Collection

Data collection took place on days 0, 3, 7, 10, and 14 of the experiment. Observations were made regarding changes in the skin condition of goats suffering from scabies, including parameters such as alopecia, skin thickening, scab formation, and the overall healing time.

Observed Parameters

The healing rate of scabies in the goats was assessed based on changes in the above-mentioned parameters. The scoring system used for evaluation is outlined in Table 1 below.

Data Analysis

The data obtained from the experiment were analyzed for homogeneity using the Levene's Test. Since the data distributions were found to be non-homogeneous, the Kruskal-Wallis Test was subsequently employed to analyze the differences between the treatment groups. If a significant difference was detected, the Mann-Whitney Test was used to identify the specific differences between treatments.

Table 1. Scoring of observed parameters

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Score	Alopecia	Skin Thickening	Scab
1	100% of skin infected with scabies experience alopecia	100% of the skin infected with scabies experiences thickening	100% of the skin infected with scabies has scabs
2	75% of skin infected with scabies experience alopecia	75% of the skin infected with scabies experiences thickening	75% of the skin infected with scabies has scabs
3	50% of skin infected with scabies experiences alopecia	50% of the skin infected with scabies experiences thickening	50% of the skin infected with scabies has scabs
4	25% of skin infected with scabies experiences alopecia	25% of the skin infected with scabies experiences thickening	25% of the skin infected with scabies has scabs
5	0% of skin infected with scabies experiences alopecia	0% of the skin infected with scabies experiences thickening	0% of the skin infected with scabies has scabs

Sources: (Cahyani et al., 2021; Risyani et al., 2018)

RESULTS AND DISCUSSION

The administration of Jatropha curcas seed extract linimentum to goats infected with scabies resulted in significant differences between treatments ($P<0.05$). Based on the scoring assessment of the alopecia parameter, treatment P0 did not differ significantly from P2 but was significantly different from P1, P3, and P4. Regarding the scoring assessment of the skin thickening and scab parameters, P0 was significantly different from P1, P2, P3, and P4, and P2 was significantly different from P1, P3, and P4. The lowest scores were observed in P0 treatment, with an average alopecia score of 1.00±0.00, skin thickening score of 1.25±0.50, and scab score of 1.25±0.50. The highest scores were found in P4 treatment, with an average alopecia score of 4.00±0.82, skin thickening score of 4.00±0.82, and scab score of 4.00±0.82. Detailed scoring results for scabies healing parameters in goats after administration of Jatropha curcas seed extract linimentum are presented in Table 2.

Table 2. Average scoring of scabies recovery parameters in goats after Jatropha curcas seed extract linimentum administration

Parameter	Treatment				
	P0	P1	P2	P3	P4
Alopecia	1.00±0.00^{a}	3.75±0.50^{b}	1.50±0.58^{a}	3.75±0.50^{b}	4.00±0.82^{b}
Skin Thickening	1.25±0.50^{a}	3.50±0.58^{c}	2.25±0.50^{b}	3.50±0.58^{c}	4.25±0.50^{c}
Scab	1.25±0.50^{a}	4.25±0.50^{c}	2.50±0.58^{b}	3.75±0.50^{c}	4.25±0.50^{c}

Note: ^{ab}Means different superscripts in the same row significantly differ ($P<0.05$); P0= negative control with linimentum Oleum coccos; P1= positive control with linimentum sulfur ppt; P2= linimentum Jatropha curcas seed extract 10%; P3= linimentum Jatropha curcas seed extract 20%; and P4= linimentum Jatropha curcas seed extract 40%

The time required to cure scabies in goats treated for 14 days revealed significant differences between linimentum sulfur ppt and linimentum Jatropha curcas seed extract. In cases of mild scabies severity, healing time varied significantly between treatments, with P4 showing the fastest healing time, averaging 3.25±0.50 days, while P0 required the longest healing time, with an average of 10.75±0.96 days. In cases of moderate scabies severity, healing time also differed significantly between treatments, where P4 required the fastest healing time, averaging 5.50±0.58 days, while P0 had the longest healing time, averaging 14.00±0.82 days. In severe scabies cases, there was a significant difference in healing time, with P4 demonstrating the fastest healing time, averaging 6.25±1.50 days, while P0 had the longest healing time, averaging 14.25±0.96 days. Detailed results on the average healing time for scabies in goats after the application of Jatropha curcas seed extract linimentum are shown in Table 3.

The administration of Jatropha curcas seed extract linimentum to goats infected with scabies demonstrated significant therapeutic potential, with the 40% concentration showing the best results across all parameters (alopecia, skin thickening, and scab formation). The effectiveness of Jatropha curcas seed extract is comparable to the positive control, linimentum sulfur ppt, a widely used scabies treatment. This indicates that Jatropha curcas seed extract may serve as a viable alternative treatment for scabies in goats.

The observed peeling of scabs after the application of Jatropha curcas seed extract linimentum is likely attributed to the presence of coumarin derivatives, particularly furocoumarins,

in Jatropha curcas. Furocoumarins have photosensitizing properties, which, when exposed to sunlight, can induce phototoxicity. This is characterized by increased blood flow to surface capillaries and damage to skin cells, resulting in the sloughing of scabs. According to Sawitri and Yuningsih (2020), furocoumarins may also inhibit cytochrome P450 enzyme activity, affecting the organism's detoxification capacity. Furthermore, the scab shedding process was accelerated when goats were exposed to sunlight, which suggests that the sun's exposure enhanced the anti-acaricide effect of the Jatropha curcas extract, likely due to the increased concentration and activation of the extract through the heat from the oil.

Table 3. The average duration of recovery for scabies in goats after giving linimentum Jatropha curcas seed extract

Severity of Sabies	Recovery Time (Days)				
	P0	P1	P2	P3	P4
Light	10.75±0.96^{d}	3.50±0.58^{a}	6.75±0.96^{c}	4.75±0.50^{b}	3.25±0.50^{a}
Moderate	14.00±0.82^{d}	6.25±0.96^{ab}	9.25±1.50^{c}	7.50±0.58^{b}	5.50±0.58^{a}
Severe	14.25±0.96^{d}	7.50±1.29^{ab}	10.25±1.26^{c}	9.00±0.82^{bc}	6.25±1.50^{a}

Note: ^{ab}Means different superscripts in the same row significantly differ (P<0.05); P0= negative control with linimentum Oleum coccos; P1= positive control with linimentum sulfur ppt; P2= linimentum Jatropha curcas seed extract 10%; P3= linimentum Jatropha curcas seed extract 20%; and P4= linimentum Jatropha curcas seed extract 40%

The healing process of scabies in goats is supported by various active compounds in Jatropha curcas seeds, including acetogenins, tannins, alkaloids, flavonoids, and steroids. Acetogenins act as antifeedants against ectoparasites, particularly Sarcoptes scabiei mites, by inhibiting cellular respiration, leading to mitochondrial dysfunction and ultimately death of the mites (Raoof and Mohamed, 2020). This disruption in the respiration process prevents the mites from obtaining the necessary energy, halting the infestation and promoting wound healing. Alkaloids and tannins play a role in preventing secondary infections through their antimicrobial and antifungal properties, while flavonoids modulate the immune response and reduce inflammation. Steroids contribute to wound healing by stimulating collagen deposition and enhancing re-epithelialization during the proliferative phase (Martínez et al., 2019).

Moreover, the administration of linimentum with Oleum coccos as a vehiculum enhances the delivery of the active compounds, ensuring their penetration to the target site under the skin, which contains fatty tissue. This facilitates the optimal effect of the treatment by targeting the mites more efficiently (Indriyani et al., 2021).

CONCLUSION

The application of Jatropha curcas seed extract linimentum has demonstrated promising potential as a therapeutic for scabies in goats. The 40% concentration of the linimentum yielded results comparable to the commonly used positive control, linimentum sulfur ppt, in terms of the healing of alopecia, skin thickening, and scab formation. This suggests that Jatropha curcas seed extract could serve as a cost-effective, natural alternative to chemical treatments for scabies in goats.

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