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Original Article

Potential of turmeric cream (*curcuma caesia* roxb.) extract in incision wounds

Ni Nyoman Wahyu Udayani [1]✉, Ketut Agus Adrianta [1], I Putu Bagus Artha Wiguna [1], Anak Agung Sagung Iswarani Yowani [1]

[1] *Bachelor of Pharmacy, Faculty of Pharmacy, Universitas Mahasaraswati Denpasar, Denpasar, Bali, Indonesia*

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CORRESPONDENCE

Phone: +62 812-4606-4647

E-mail: udayani.wahyu@unmas.ac.id

A B S T R A C T

Background: Incisional wounds are the most common wounds in the community. Improper handling of incision wounds can worsen wounds and cause infection. The content of secondary metabolites in black turmeric rhizomes can act as anti-inflammatory and antimicrobial in the healing process of incision wounds. However, its effectiveness in healing incision wounds has not been widely studied, so further research is needed.

Purpose: This study was conducted to determine the potential of black turmeric cream as an herbal medicine to heal incision wounds.

Methods: This study was an invivo experimental research study with a randomized post-test control group design. The samples used were 20 male rats that were made to have a 2 cm incision wound on the back area, consisting of a negative control, a positive control, and three black turmeric extract groups (5%, 10%, and 15%). The data obtained were analyzed by an ANOVA (Analysis of Variance) parametric statistical test.

Result: The results showed that the highest decrease in incision wound length was found in the black turmeric rhizome cream Formula III group and the lowest in the negative control group. On day 14, the incision wound area of the Formula III black turmeric rhizome cream group had closed or healed (0.00 cm), while the negative control group had the slowest incision wound closure (0.39 cm).

Conclusion: Black turmeric rhizome cream can heal and prevent infection of the incision wound. This shows the potential of black turmeric rhizome as an anti-inflammatory and antimicrobial.

INTRODUCTION

Skin is the largest organ in the human body. It mainly protects the internal organs.[1] aintaining skin integrity and strong wound-healing ability are key requirements for a healthy life.[2] Following a tissue disruption, wound healing is the body's attempt to regain structural integrity and normal function.[3] There are many types of wounds, one of which is an incisional wound that occurs intentionally or unintentionally due to being cut by a sharp object during surgery.[4] Improper wound care can lead to infection of the incision wound. Most incision wound infections are caused by microorganism contamination.[5]

Black turmeric (Curcuma caesia Roxb.) has a higher phytochemical content than other turmeric types.[6] Curcumin is a naturally occurring polyphenol found in the rhizomes of Curcuma species.[7] It has various properties, including antimicrobial, antioxidant, and anti-inflammatory activity, making it very useful in wound healing.[8] According to previous research, black turmeric rhizome can be a wound-healing agent with antimicrobial properties to keep wounds from getting infected, anti-inflammatory properties to reduce inflammation, and proliferative and regenerative properties to accelerate the process of cell proliferation and tissue remodeling.[9–11]

Cream products have advantages in healing wounds because they have good spreadability on the skin, cause a cold effect due to the slow evaporation of water, are easy to clean with water, and have good drug release. The use of black turmeric in creams has not been widely practiced. From various previous studies, no one has examined the effect of black turmeric cream on incision wounds. So, this research aimed to determine the effect of black turmeric cream on healing incision wounds. Based on this, a study

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was conducted on the black turmeric plant made as a cream preparation for wound healing in male white rats.

METHOD

Study Design

This study was an in vivo experiment with a post-test controlled group design.

Study Site

This study lasted from September 2022 to March 2023. Black turmeric rhizomes were obtained in the area of Manikliyu Village, Kintamani, Bangli Regency.

Materials

The ingredients used in this study were black turmeric rhizome simplicia, obtained in the area of Manikliyu Village, Kintamani, Bangli Regency, Bali Province, glycerin, TEA, stearic acid, atrium tetraborate, nipagin, aqua dest, ethanol 96% (Bratachem).

Black Tumeric Extract

Rhizome simplicia black turmeric is extracted by pollinating and mashing it using a slat grinder with a mesh fineness sieve size of 60. Black turmeric rhizome simplicia powder is combined with 96% ethanol solvent at a weight ratio of 1000 g of black turmeric rhizome simplicia powder after mashing it. Six liters of 96% ethanol solvent were added, and after two to three hours of stirring and shaking, the mixture precipitated and was macerated for two days. Following maceration, the filtrate is removed from the pulp by filtering it through filter paper. Following filtration, the filtrate is evaporated using a rotary evaporator for six hours at 40–50°C to produce an extract from the black turmeric rhizome.[12]

Black Tumeric Extract Cream

This cream preparation of turmeric rhizome extract is an oil-in-water emulsion with 20 g per formulation. In the preparation, the oil phase auxiliary agent is first heated to a temperature of 75ºC, then the cream made from the oil phase is lifted from the steam tank, and black turmeric rhizome extract is added. Next, the water phase auxiliary material is heated to a temperature of 75ºC, and the water phase is gradually added to the oil solution. Phase with constant stirring until cool. The cream is made of 4 preparations: 3 creams with different concentrations of turmeric rhizome extract and one without turmeric rhizome extract are used as negative controls.

Formulation of Black Turmeric Cream

The black turmeric extract cream formulations that will be used are negative control (without black turmeric extract), formula I with a concentration of 5%, formula II with a concentration of 10%, and formula III with a concentration of 15%. The ingredients for making black turmeric extract cream consist of 4 grams of stearic acid, 0.25 grams of sodium tetraborate, 1 gram of TEA, 10 grams of glycerin, 0.15 grams of nipagin, and up to 30 grams of distilled water.

Physical Quality Test of Cream Preparations

Organoleptic Test

The organoleptic test uses the five senses: shape, smell, and color. The physical quality parameters of the cream are that there is no change in shape, color, or smell from the beginning of manufacture to the time of storage until the substance is used.[13]

Homogeneity Test

One gram of cream is put into a transparent glass piece and left to be observed. The preparation needs to have uniform milk with no discernible coarse granules.[14]

pH Test

Weigh 1 gram of cream extract and dilute it with 10 ml of equates. Use a pH meter that has a sensor part and reads pH. The pH of preparations that meet the skin pH criteria is in the interval of 4.5-6.5.[15]

Spread Power Test

Weigh the cream—0.5 grams. The cream should be placed in the middle of the upside-down petri dish. After a minute, let it rest, and measure the diameter after adding a load ranging from 50 to 250 grams per minute. The cream's spreadability satisfies the 5–7 cm requirements.[16]

Adhesion Test

The adhesion test can be done by applying 0.5 grams of cream to a glass plate. Then, the glass plate is attached until the plate is fused, and a load weighing 250 grams is given for 5 minutes. Record the time until the two plates come off each other. The standard of good cream adhesion is > 4 seconds.[17]

Stability Test

The six-cycle assessment of physical stability can be sped up using a stability test. The cream is kept in cold storage for 24 hours at a temperature of ± 400°C. After that, it is removed and kept at the same temperature for another 24 hours (one cycle). The cream's physical state is homogeneity, dispersion, pH, and organoleptic.[18]

Experimental Procedure

This study used 20 rats divided into five treatment groups: negative control, positive control, and three treatment groups. Before cutting and shaving the rat's body, anesthetize the rat first using ether liquid 3 mL - 5 mL until the condition of the rat decreases consciousness as seen by the weakening of the rat's muscles to move, then proceed to shave the rat's fur at the point where the incision wound will be made. After the fur is shaved, mark the back of the rat to be cut, apply an alcohol swab at the marked point, and make an incision on the rat's back with a sterile scalpel with a wound depth of 2 mm and a wound length of 2 cm. In the negative control group, a cream base was given, and the positive control was given gentamicin cream; then, for three treatment groups, namely treatment group 1 was given black turmeric rhizome cream with a concentration of 5%, treatment group 2 was given black

turmeric rhizome cream with a concentration of 10%, and for treatment group 3 was given black turmeric rhizome cream with a concentration of 15%, the healing of the incision wound will be seen for 14 days.

Data Analysis

The data analysis in this study was carried out statistically using the SPSS 25.0 application. The data obtained from the wound length of the incision was then statistically tested using the One-way ANOVA test followed by post hoc LSD to see significant differences between treatment groups.

Ethicals Considerations

This research has been approved by the research ethics committee of Udayana University Faculty of Veterinary Medicine with the number B/263/UN14.2.9/PT.01.04/2022.

RESULTS

Black Turmeric Rhizome Extract Yield

This study determined the effectiveness of black turmeric rhizome extract cream with a concentration of formula 1, 5%, formula 2, 10%, and formula 3, 15%, on the length of incision wounds in white rats. The preparation of turmeric rhizome extract in this study used the maceration method using 96% ethanol solvent with a ratio of 1 10 carried out repeatedly twice with 300 grams of simplisia using 96% ethanol solvent as much as 3 liters in the first maceration process and 3 liters for the second maceration process. In this study, black turmeric rhizome extract was produced at 300 grams of simplicia with 3 liters of 96% ethanol solvent and was 63 grams, so the percentage of extract yield was 21%. Phytochemical screening tests were conducted to determine the compounds contained in black turmeric rhizome extracts with their respective solvents. These results show four types of compounds: flavonoids, triterpenoids, tannins, and alkaloids.

Physical Quality Test Results

The results of making black turmeric rhizome extract cream include concentrations, with the ratio being formula 1, namely 5% black turmeric rhizome extract as much as 1.5 grams, formula 2, namely 10% black turmeric rhizome extract as much as 3 grams, and formula 3, namely 15% black turmeric rhizome extract as much as 4.5 grams. The results of the cream can be seen in Figure 1.

The results of the physical quality test of black turmeric rhizome extract cream include an organoleptic test, preparation pH test, homogeneity test, adhesion test, and dispersion test, which can be seen in Table 1. The test results show that the higher the extract concentration, the more intense the color of the black turmeric extract cream and the longer the adhesion.

Results of Experimental Animal Treatment

The length of the incision wound on the 14th day after being treated was measured by measuring the length using a caliper, as shown in Table 2. Figures 2 and 3 show decreased wound length diameters in incision wounds. Table 3 shows that the group that received black turmeric extract cream had a faster wound length decrease than the negative control group. The highest decrease was in the formula 3 group that received black turmeric extract cream with a concentration of 15%, as seen in Figure 1. The administration of black turmeric extract cream for 14 consecutive days affected the length of the incision wound, which significantly became smaller and did not even leave a scar.

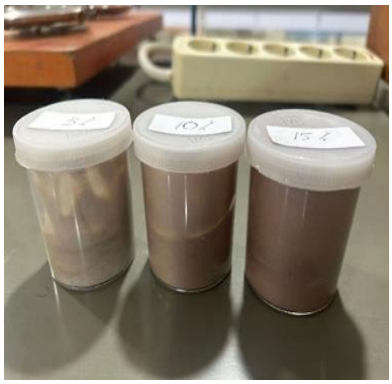

Figure 1. Black turmeric rhizome extract cream

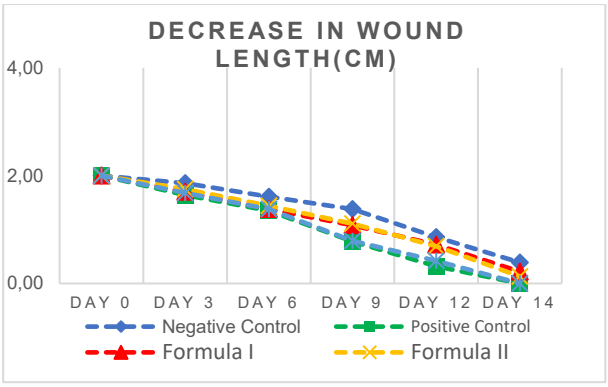

Figure 2. Wound length reduction graph

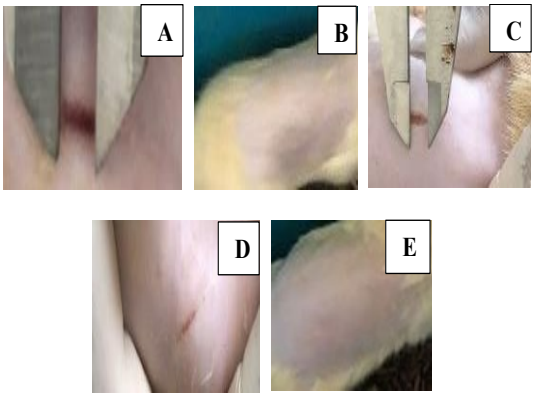

Figure 3. Cut wounds after 14 days, (A) Negative Control; (B) Positive Control; (C) Formula I; (D) Formula II; (E) Formula III

Table 1. Physical Quality Test of Black Turmeric Cream

Testing	Result		
	F1 5%	F2 10%	F3 15%
Organoleptic	Light gray color, Smells Typical of spices, Homogeneous	Gray color, Smells typical of spices, Homogeneous	Dark gray color, Smells Typical of spices, Homogeneous
pH	6	6	6
Adhesion	6,5 seconds	7,67 seconds	8,37 seconds
Spread power	6 cm	6 cm	6,5 cm

Table 2. Measurement of Incision Length (cm)

Day	Negative Control	Positive Control	Formula 1	Formula 2	Formula 3
0	2,00	2,00	2,00	2,00	2,00
3	1,86^{b}	1,64^{a}	1,70^{a}	1,75^{ab}	1,68^{a}
6	1,61^{b}	1,35^{a}	1,38^{a}	1,44^{ab}	1,38^{a}
9	1,38^{b}	0,78^{a}	1,08^{ab}	1,11^{ab}	0,79^{a}
12	0,86^{b}	0,32^{a}	0,72^{ab}	0,69^{ab}	0,42^{a}
14	0,39 ^{b}	0,00 ^{a}	0,22 ^{ab}	0,13 ^{ab}	0,00 ^{a}

Description: the value is presented with an average; (a, $p \leq 0.05$) showed a significant difference with negative control; (B, $P \leq 0.05$) showed a significant difference with the positive control.

DISCUSSION

In this study, black turmeric rhizome extract was formulated into a cream for its ease of application and good absorption properties. Physical quality tests indicated that all cream formulations had a pH of 6, aligning with the safe topical pH range of 4.5–6.5, and exhibited good homogeneity without coarse particles. Additionally, adhesion and spreadability tests met established standards, ensuring the cream spreads evenly and supports optimal wound healing.[14]

Observations on test animals revealed that the group treated with black turmeric rhizome extract cream experienced a significant reduction in wound length compared to the negative control group. The formula with a 15% concentration demonstrated the highest anti-inflammatory effectiveness over a 14-day treatment period. This finding is consistent with previous research indicating that black turmeric rhizome extract exhibits anti-inflammatory activity through selective inhibition of COX-2 with minimal effect on COX-1.[24]

Beyond curcumin, black turmeric contains sesquiterpene compounds with antibacterial properties that disrupt bacterial protein structures. Curcumin, a phenolic compound, interacts with bacterial cell walls, leading to protein denaturation and cell membrane lysis. Alkaloids and triterpenoids in black turmeric also contribute antibacterial effects, support collagen formation, and aid in hemostasis.[19]

Natural wound healing involves three interconnected stages: inflammation, proliferation, and remodeling. During the inflammatory phase, neutrophils and macrophages remove wound debris and release cytokines. The proliferation phase involves fibroblast infiltration and deposition of new extracellular matrix, initiating re-epithelialization. Finally, collagen synthesis and fibroblast activity facilitate further tissue remodeling. Each stage must occur in the correct sequence and timeframe to ensure complete healing.[20-21]

Previous studies have demonstrated that black turmeric rhizome exhibits antimicrobial activity against various bacteria, including Bacillus cereus, B. subtilis, Staphylococcus aureus, Staphylococcus epidermidis, Escherichia coli, Proteus vulgaris, and Klebsiella pneumoniae.[22-24] Curcumin, a key active component, possesses anti-inflammatory, anticancer, antimutagenic, and antimicrobial properties. Its antioxidant activity reduces reactive oxygen species (ROS) production by inhibiting NADPH oxidase and enhancing antioxidant enzyme activity associated with the Nrf2-Keap1 pathway.[10]

Curcumin also promotes hydroxyproline and collagen synthesis, accelerates collagen fiber maturation, and induces early-phase apoptosis, shortening the inflammatory phase and expediting wound healing.[8,25–27]. ther antioxidants in black turmeric extract, such as flavonoids, saponins, and tannins, also exhibit anti-inflammatory effects.[28] Saponins facilitate wound closure by stimulating fibroblast proliferation and collagen formation, essential for wound contraction and tissue epithelialization.[29]

However, this study has certain limitations. The use of animal models may not fully represent human responses. Additionally, the long-term effects of black turmeric rhizome extract cream were not evaluated. Further research is

necessary to confirm these findings in human subjects and assess prolonged use's safety and efficacy.

CONCLUSIONS AND RECOMMENDATION

Phytochemical compounds in black turmeric rhizomes exhibit anti-inflammatory properties, with a 15% extract cream showing optimal effects on rat incision wounds. The recommendation is to further investigate curcumin's antioxidant potency and develop alternative pharmaceutical formulations for black turmeric rhizome extract.

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