

Potency of Turmeric Extract (*Curcuma domestica* Val.) with Virgin Coconut Oil (VCO) Against Incision Wound Healing

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Abstract

Wounds are damage or loss of body tissues that occur due to a factor that interferes with the body's protective system. One example of an open wound is an incision where there is a linear tear in the skin and underlying tissue. One natural ingredient that has potential as an alternative treatment for cut wounds is turmeric and VCO. The part of turmeric contains curcumin to accelerate wound healing and VCO contains lauric acid which functions as an antibacterial. The purpose of this study was to determine the effect of the combination of turmeric extract (*Curcuma domestica* Val.) with Virgin Coconut Oil (VCO) on the percentage and healing time of incision wounds in male mice (*Mus musculus* L.). This research is an experimental study. The research was conducted from October to December 2023 at the Animal House and Research Laboratory of the Department of Biology, Faculty of Mathematics and Natural Sciences, Padang State University. The design used is a Complete Randomized Design (RAL) with 5 (five) treatments and 5 (five) repeats. The data obtained were analyzed using the ANOVA (Analysis of Variance) test using the SPSS 22 application. The results showed that the combination of turmeric extract (*Curcuma domestica* Val.) with Virgin Coconut Oil (VCO) affected the percentage and time of incision wound closure in male mice (*Mus musculus* L.). The best combination of turmeric extract with VCO is a ratio of 2:1.

Keywords: Turmeric extract; VCO; incisions; male mice.

INTRODUCTION

A wound is defined as an injury to body tissue caused by sharp or blunt trauma, temperature changes, chemicals, explosions, electric shocks, or animal bites. Problems that arise in acute wounds are pain due to the release of cellular humoral elements in nerve endings, swelling due to fluid accumulation in the tissues around the wound, and discomfort due to inflammatory processes such as redness and heat due to vasodilation of blood vessels (Clausen & Laman, 2017). In Indonesia, based on Riskesdas data (2013), the proportion of wound types or types of injuries that are predominantly due to trauma are abrasions / bruises (70.90%), sprains (27.5%), and lacerations (23.2%). The number of injuries caused by sharp object trauma that is easily infected with bacteria when left or given synthetic chemical drugs that have side effects on body health (Riani, 2022). The use of drugs on wounds aims to accelerate the healing process (Safari et al., 2019). The wound healing process takes place naturally or with chemical assistance, such as with medicinal substances, ointments and others (Qomariah et al., 2014).

In addition to using chemical drugs, people also use traditional medicines in the treatment of wounds, such as

aloe vera, betel leaf, and sambiloto. Plants that have always been a mainstay as traditional medicine, one of which is turmeric. Turmeric has a chemical content that is a yellow dye called curcuminoids. Curcuminoids can act as antioxidants, which can prevent cell damage caused by free radicals. In addition, curcuminoids can also be anti-inflammatory (Winarto & Tim Lentera, 2004). In vitro and in vivo studies show that turmeric has antibacterial activity, anti-inflammatory (anti-infective), activity against peptic ulcers, antitoxic, anti-hyperlipidemia, and anticancer activity (Sutardi et al., 2022). The curcumin content in turmeric plays a role in wound healing and skin regeneration. Turmeric also contains quinone compounds, flavonoids, saponins, tannins and alkaloids that play a role in the wound healing process as antibacterial (Ningtyas, 2017).

Research conducted by Maan et al. (2020), namely the administration of turmeric rhizome extract and gentamicin ointment for healing mouse skin incision wounds, proved that incision wounds given turmeric rhizome extract had undergone complete closure with scars and hairs growing around the wound on the 14th day. In Handayani's research (2022), it was concluded that the use of a thick turmeric rhizome extract cream formula with a dose of 15% has the same incision wound

healing activity as a dose of 5% and a dose of 10%. Research by Susanto et al. (2023), a combination of turmeric rhizome extract and whitening at a composition of 1: 1; 2:1 and 1:2 can accelerate wound healing and have anti-inflammatory activity.

In addition to turmeric, VCO is also known as a very efficacious traditional medicine. The benefits when VCO is applied to scratches and wounds, can form a thin layer that protects wounds from external dust, bacteria, and viruses so as to speed up the healing process and no side effects have been found (Sumiasih, 2016). The function of VCO as a strong antioxidant, because VCO contains vitamin E and polyphenols. In addition, VCO has antioxidant, antimicrobial, antifungal abilities, protecting the skin from the dangers of free radicals and tissue degeneration (Zikran, 2023). The bioactive compounds in coconut oil are thought to be responsible for antioxidant activity; anti-inflammatory, anti-pyretic, analgesic, and hypolipidemic VCO (Fernando, 2015). According to research conducted by Fatonah et al.; (2013); concluded that the use of VCO tropically against the healing process of grade I and II pressure wounds is more effective using VCO than ordinary coconut oil. Research that has been conducted previously by Wijaya (2013), proves that aloe vera extract cream using a cream base containing VCO is able to provide effectiveness faster than aloe vera extract not using VCO. The use of VCO is able to accelerate wound healing because it is an oil that contains medium chain saturated fatty acids that support healing and repair of body tissues.

Based on the background that has been described, the combination of turmeric and VCO has the potential to be used as a better wound-healing drug. Research on the effect of the combination of turmeric extract (*Curcuma domestica* Val.) with Virgin Coconut Oil (VCO) as a wound healer in male mice (*Mus musculus* L.) needs to be done.

MATERIALS AND METHODS

Learning areas

This type of research is experimental research. This research was conducted in October – December 2023. The manufacture of turmeric extract (TE) is carried out in the research laboratory, maintenance and treatment of mice is carried out at the House of the Animal Division of the Department of Biology, Faculty of Mathematics, Natural Sciences, Padang State University. The tools used in the study were mouse cages, wire covers, digital scales, set sets, cameras, gloves, markers, calipers, sterile holders, beaker glass, stirring rods, Vacuum Rotary Evaporator, hot plates, vortexes, erlenmeyer, test tubes, measuring cups, razors, drinking pacifiers, bottle containers, spoons, and stationery. The ingredients used are fresh turmeric from the city of Padang, male mice (*Mus musculus* L.) as many as 25 heads aged 2-3 months, aquades, Virgin Coconut Oil (VCO), betadine, 70%

alcohol, 96% methanol, filter paper, tissue, pellet feed, labels, and cotton buds. The design used was a Complete Randomized Design (RAL) with 5 (five) treatments with 5 (five) repetitions consisting of negative control, positive control (betadine), P1 (TE + VCO 1: 1), P2 (TE + VCO 1: 2), P3 (TE + VCO 2: 1).

Procedure

Research Preparation

▪ Turmeric extract processing

The preparation of this extract was carried out at the Research Laboratory of the Department of Biology, Faculty of Mathematics and Natural Sciences, Padang State University. Turmeric rhizomes are processed by peeling the skin, washing, cutting thinly, drying in the aeration, after drying ground and sifted. Then, 200 grams of turmeric that has been sifted is put into an airtight bottle then filled with 96% methanol until submerged. The container is tightly closed and placed at room temperature for 7×24 hours, then filtered with filter paper. Turmeric extract solution is concentrated using a Vacuum Rotary Evaporator with a temperature of 60 degrees Celsius so that a thick extract is obtained. Furthermore, the turmeric extract obtained is diluted according to the treatment.

▪ Making a Combination of Turmeric Extract and VCO

The preparation of the combination of turmeric extract with VCO is each made 10 ml with different treatment concentrations, first the combination of turmeric and VCO 1: 1, the combination of turmeric and VCO 1: 2 and the combination of turmeric and VCO 2: 1. Turmeric extract that has been weighed is put into a test tube and then added VCO that has been heated with a hot plate at each concentration, then a combination in the vortex. After, let it cool and then put it in the bottle provided.

Research Implementation

After the mice were acclimatized for 7 (seven) days, the mice that had been placed according to each group were then carried out the incision wound making process. Before making wounds, the process of shaving the hair on the back of mice is carried out. The hair on mice is shaved first with a size of 3 cm, and the skin is disinfected with 70% alcohol. Next, the incision wound is made using razor blades that have been sterilized with 70% alcohol. Making wounds with a sterile scalpel is done by incision on the skin of the back area until a 20 mm wound is formed with a depth to reach the dermis characterized by blood discharge.

In the K + group, betadine was given, P1 was given a combination of turmeric extract and VCO 1: 1, P2 was given a combination of turmeric extract and VCO 1: 2, and P3 was given a combination of turmeric extract and VCO 2: 1. By applying using a cotton swab evenly on the surface of the incision wound. The treatment is given 2 (two) times a day (morning and evening) until the

wound closes. Observations were made to measure a decrease in wound length and wound closure time.

Data analysis

The data in this study are the percentage of wound closure and the time it takes to close. The research data was analyzed statistically through the ANOVA (Analysis of variance) One Way Anova test using the SPSS 22 application. If the results of the ANOVA test are significantly different at a significant level of 5%, Duncan's follow-up test is used.

RESULTS AND DISCUSSION

Result

Research on the effect of the combination of turmeric extract (*Curcuma domestica* Val.) with Virgin Coconut Oil (VCO) on incision wound healing in male mice (*Mus musculus* L.) showed differences in the percentage of wound closure and wound closure time in each treatment during observation (Figure 1).

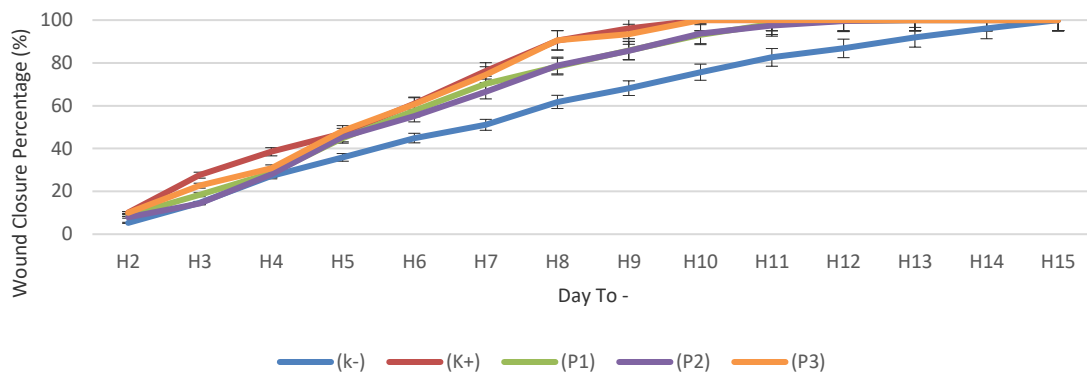


Figure 1. The percentage of incision wound closure in the combination of turmeric extract and VCO. Description: K- = negative control, K+ = positive control, P1 = combination of turmeric extract with VCO ratio 1: 1, P2 = combination of turmeric extract with VCO ratio 1: 2, P3 = combination of turmeric extract with VCO ratio 2: 1.

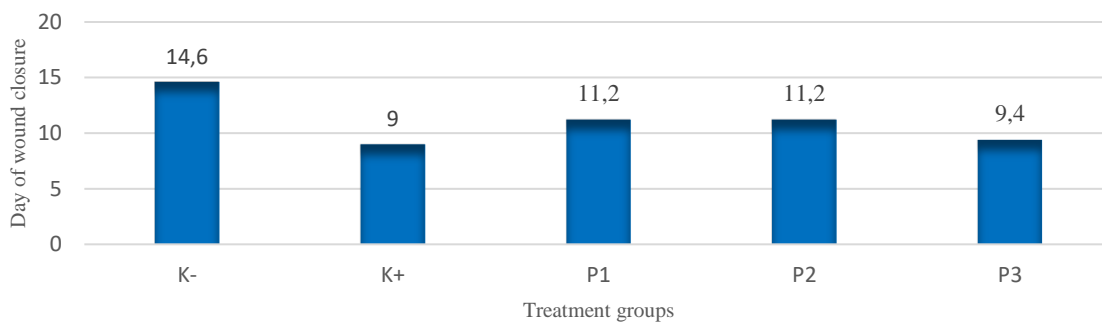


Figure 2. Closing time of mouse incision wound

Figure 2 shows the average closure time of different mouse skin incision wounds in each treatment given. The fastest wound closure is shown by K+ and P3 treatment, which is 9 (nine) days, followed by P1 and P2 with a wound closure duration of 11 days and K- about 15 days. The results of Anova's statistical analysis showed that the combination of turmeric extract with VCO had a significant effect on the length of healing time for mouse incision wounds with a significance value of < 0.05, so that Duncan's further test was carried out.

Table 1. Duncan test results in long closure of mouse incision wounds. Description: Different alphabets show a significant difference (p<0.05).

Treatment	Mean ± SD (Day)
K-	14,6 ± 0,49 ^a
K+	9,4 ± 1,20 ^c
P1	11,2 ± 0,98 ^b
P2	11,2 ± 0,75 ^b
P3	9,4 ± 1,20 ^c

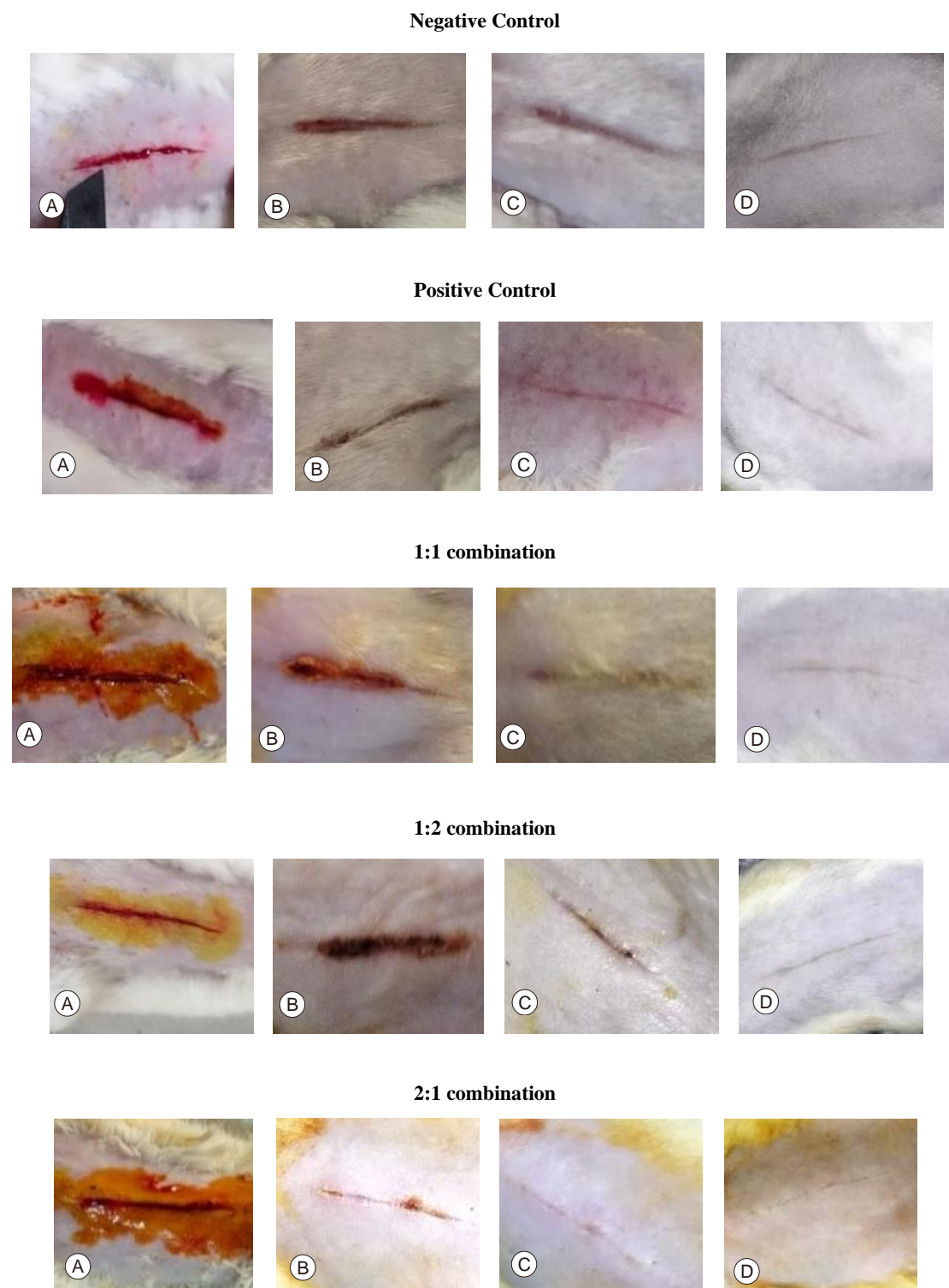


Figure 3. Description of mouse incision wounds days 0,5,10,15. Remarks: (A) day 0, (B) day 5, (C) day 10, and (D) day 15.

Discussion

The results of this study showed that the treatment group given betadine and a combination of turmeric extract with VCO ratio of 2: 1 provided the largest reduction in wound length compared to other combinations and also the fastest wound closure duration. Figure 3 shows the

best wound closure on days 9 and 9.4 with betadine and turmeric extract combination with VCO ratio 2: 1. The condition of the wound has dried and closed completely. The negative control showed the smallest reduction in wound length at day 14.6, lasting wound healing compared to the other treatment group.

The calculation of the percentage of wound healing showed a positive control, a combination of 1: 1, 1: 2 and 2: 1 had the fastest healing rate of 100% when compared to the negative control group of 96.10% on day 14. incision wound closure time is fastest through morphological features and also statistical analysis is shown by K+ and P3 followed by P1, P2 and K-. This shows that the combination of turmeric extract with VCO can speed up the process of closing incision wounds in mice. This is likely due to the curcumin content in turmeric extract which can reduce the duration of the inflammatory phase that occurs in wounds so as to accelerate wound healing and VCO which can be efficacious as an antimicrobial that can prevent infection in wounds. Milasari et al. (2019) stated that the use of turmeric as a wound healing ingredient can accelerate the wound healing process because curcumin compounds have anti-inflammatory and antioxidant properties and encourage cell re-epithelialization cell proliferation and collagen synthesis.

The combination of turmeric extract with VCO ratio of 2:1 showed the best wound closure duration compared to other combination treatments. The results of the study are in accordance with the results of research by Susanto et al. (2023), which concluded that the observation of a combination of turmeric rhizome extract and whitening with a composition of 2: 1 was able to accelerate the healing of incision wounds. The flavonoids, alkaloids and triterpenoids in turmeric have anti-inflammatory effects and also contribute to the fight against infections caused by microorganisms that can help prevent infection in wounds and accelerate wound healing. The mechanism of action of flavonoids and alkaloids as an antibacterial is by disrupting the constituent components of peptidoglycan in bacterial cells, so that the cell wall layer is not formed intact and causes the death of these bacterial cells (Susanto et al., 2023). Saponins have the ability as cleaners and antiseptics that function to kill germs or prevent the growth of microorganisms that usually arise in wounds so that wounds do not experience severe infections (Wijaya et al., 2014). Triterpenoids help strengthen skin structure, increase antioxidant concentrations in wounds and restore inflammatory or inflamed tissue by increasing blood supply to the wound area, and help speed up the wound closure process (Susanto et al., 2023).

This study showed that the composition of turmeric that is greater than the composition of VCO (2: 1) is better in the process of wound closure. This is because the curcumin content in turmeric plays a role in anti-inflammatory and antioxidant and encourages reepithelialization, cell proliferation and collagen synthesis needed in wound closure. Meanwhile, VCO in the wound closure process acts as an antibiotic, antibacterial, antifungal and antiviral (Putri et al., 2021). This is in accordance with the mechanism of wound closure according to Kim et al. (2012); that in the wound healing process, there is a wound healing mechanism

consisting of 4 phases, namely hemostasis, inflammation, proliferation and remodelling. Curcumin compounds in turmeric are known to inhibit thrombin clotting and play a role in accelerating the inflammatory phase, increasing tissue collagen density and increasing the proliferation of fibroblast tissue. In addition, the flavonoid content in turmeric extract increases the number of macrophages. An increase in the number of macrophages increases fibroblast proliferation, so that both proliferation and remodeling phases take place faster. In addition, the content of saponins in turmeric extract is also able to increase fibroblast proliferation (Arisonya et al., 2014).

The use of VCO in this study helps reduce inflammation because VCO has unsaturated fatty acids in the form of oleic acid, linoleic acid, and flavonoids that function as anti-inflammatory (Ribeiro et al., 2014). The anti-inflammatory and antibacterial effects of VCO accelerate the inflammatory process by reducing inflammatory mediators and the wound healing process can immediately enter the proliferation phase. In addition, moisture is required in the wound healing process for the activity of growth factors and the activity of proteolytic enzymes. Proteolytic enzymes in VCO have a role in the tissue repair process. They are able to activate the synthesis and deposition of protein matrix components in granulation tissue, so that it will accelerate the re-epithelialization process in wounds (Khiftiyah, 2018). Based on the results of research by Sumiasih et al. (2016), it was suggested that perineal wounds treated according to APN standards plus VCO healed faster than those treated according to APN. This is because VCO has antibacterial, antiviral, antifungal properties, and when applied over the wound can coat the wound and protect the wound from contamination of dirt such as dust and other dirt.

The results of research conducted by Maan et al. (2020), namely the administration of turmeric rhizome extract and gentamicin ointment for healing mouse skin incision wounds, proved that incision wounds given turmeric rhizome extract had undergone complete closure with scars and hair growth around the wound on the 14th day. In addition, research conducted by Susanto et al. (2015), the antibacterial effect of Virgin Coconut Oil against Methicillin Resistant *Staphylococcus Aureus* proves that topical administration of VCO can reduce wound size starting on day 14. The results of this study showed that incision wounds given a combination of turmeric extract with VCO ratio 2: 1 have experienced complete wound closure on the 9.6th day by leaving scars and growing fine hair in the area around the wound. Judging from the characteristics of healed wounds based on histologic according to Amita et al. (2017), the density of collagen fibres in the wound area is denser than incision wounds after aqueous administration and fibroblast cells are few and the spread is rare. From these results, it can be proven that the use of a combination of turmeric extract with VCO is better for healing incision wounds compared to separate treatments.

The difference in wound closure time in the turmeric extract with VCO combination treatment group was not only caused by differences in the composition of turmeric extract and VCO given but also influenced by wound healing factors, including stress factors, nutrition / nutrition, tissue perfusion, circulation disorders, metabolic changes, early mobilization, age and obesity (Potter, 2011). According to Maryunani (2014), factors that affect wound healing such as oxygenization, hematoma, age, nutrition, sepsis, medications, lifestyle and mobilization. Factors affecting wound healing, according to Hidayat (2009), are Vascularization, anaemia, age, other diseases, nutrition and obesity.

CONCLUSION

The combination of turmeric extract (*Curcuma domestica* Val.) with Virgin Coconut Oil (VCO) affects the percentage and timing of wound closure in male mice (*Mus musculus* L.). The best combination of turmeric extract with VCO is a ratio of 2: 1.

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