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Wound Healing Potential of *Rynchophorus phoenicis* Oil in Wistar Rats

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Abstract

The process of wound healing is a complicated biological process that repairs damaged tissue by involving successive stages of repair. Natural products have become of interest as alternative wound healing agents due to their availability, affordability and potential therapeutic effects. In this study, the potential of Rhynchophorus phoenicis oil was assessed using an excision wound model in Wistar rats. The 10%, 20% and 30% R. phoenicis oil were prepared using a standard ointment base of cetostearyl alcohol, wool fat, hard paraffin and white soft paraffin. Twenty Wistar rats were randomly divided into five groups (n = 4). Group I was the negative control (vehicle), Group II was treated with penicillin ointment (positive control), and Groups III-V were treated with 10%, 20% and 30% oil ointments of R. phoenicis respectively. Excision wounds were done on the dorsal area and topical treatment was done daily for 10 days. On days 0, 3, 7 and 10, wound contraction was measured. Progressive wound contraction was observed in all groups. However, there was no statistically significant difference (p > 0.05) between the treated groups and the control group at all time points. There was also no significant improvement of the positive control over the control. In conclusion, oil of Rhynchophorus phoenicis did not significantly increase wound healing at the concentrations used. The healing effects could have been due to the ointment base used. It is suggested that further research needs to be conducted to optimize the formulation and test more healing parameters.

Keywords: *Rhynchophorus phoenicis, Wound healing, Wistar rats, excision model, natural products.*

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INTRODUCTION

Wound healing is an important biological process that restore the structure and functionality of damaged tissues (Choudhary et al., 2024). It takes place in an orderly sequence of overlapping stages, i.e., hemostasis, inflammation, proliferation, and remodeling (Sindhu et al., 2025). All these stages involves complex cellular and biochemical actions, which are required to facilitate healthy tissue repair (Gurtner et al., 2008). However, the healing process can be affected by several factors such as infection, poor nutrition, underlying diseases, and immune status (Morales et al., 2023). These challenges have led to the growth of chronic wounds and delayed healing particularly in vulnerable people (Guo & DiPietro, 2010).

The use of natural products in managing wounds has gained more interest in the past few years. This can be greatly attributed to their accessibility, low cost, and limited chances of side effects relative to synthetic drugs (Moses et al., 2023). The use of natural oils of plants, animals, and insects is of particular interest due to the presence of bioactive compounds in them, including fatty acids, antioxidants, and antimicrobial agents (Rahim et al., 2023). These components are also known to aid in tissue healing, decrease inflammation, and prevent wound infection (Boateng and Catanzano, 2015).

Rhynchophorus phoenicis, commonly known as the African palm weevil is a natural product that has gained attention (Siddiqui et al., 2024). The insect larvae are commonly consumed in West and Central Africa since they contain a lot of nutrients, particularly their protein and lipid content (Ekpo & Onigbinde, 2007). The oil extracted from the larvae has traditionally been used in many ways, such as skincare and even healing minor ailments (Siddiqui et al., 2024). Important fatty acids like palmitic acid, oleic acid, and linoleic acid are abundant in the oil and they are significant in terms of skin integrity, control of inflammation, and tissue regeneration (Fasoranti and Ajiboye, 1993; Ekpo et al., 2009).

Linoleic and oleic acids are fatty acids, which are involved in the repair of cell membranes and the precursors of prostaglandin that play a role in wound healing process (Calder, 2006). Previous studies have shown that oils rich in lipids can enhance wound contraction, collagen formation, and epithelialization (Akinniyi et al., 2014). Although these are the beneficial qualities and it is used traditionally, the scientific evidence of wound healing effects of *R. phoenicis* oil is limited especially in controlled experimental models.

The aim of this study is to compare wound healing of *Rhynchophorus phoenicis* oil using an excision wound on Wistar rats. The research is aimed at determining wound contraction and comparing its effects with standard treatment. The results of this study could be valuable in informing the possibility of using this natural oil as a cheap and readily available wound healing agent, particularly in low-resource communities.

METHODOLOGY

Chemicals and Reagents

The ointment base consisted of cetostearyl alcohol, hard paraffin, wool fat and white soft paraffin. *Rhynchophorus phoenicis* oil was used as the active ingredient. The oil sample was extracted and provided by Vaikken et al. (2025).

Formulation of Ointments.

The 20% *Rhynchophorus phoenicis* Oil Ointment is made by preparing a 20% solution in oil.

An ointment with the weight of 20 g was prepared weighing 1 g of cetostearyl alcohol, 1 g of hard paraffin, 1 g of wool fat, 16.6 g of white soft paraffin, and 0.4 g of *R. phoenicis* oil. Everything was put in a clean stainless steel container and heated in a water bath with continuous stirring until a uniform mixture was obtained. The melted mixture was left to cool down after which the mixture was transfered into a clean airtight container and carefully labeled.

To prepare 30 per cent *Rhynchophorus phoenicis* Oil Ointment.

The ointment was also made by weighing 1 g cetostearyl alcohol, 1 g hard paraffin, 1 g wool fat, 16.4 g white soft paraffin, and 0.6 g *R. phoenicis* oil, which made 20 g. The above procedure was repeated to achieve a homogenous ointment that was placed in an airtight container that was labeled.

Experimental Animals

This study was done using adult male Wistar rats. The animals were kept in the standard laboratory conditions with free access to food and water. They were allowed to get acclimatize to the laboratory conditions before the experiment could start.

Ethical Approval

The Department of Pharmacology and Toxicology, Faculty of Pharmacy, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria gave the ethical approval of using experimental animals.

Excision Wound Model

Excision wound model was used to evaluate the wound healing activity of the test samples. The animals were randomly divided into five groups (4 rats each). Before the wounds were made, the animals were anesthetized using chloroform inhalation. An electric clipper was used to shave off the dorsal fur and the area cleaned. Each animal was subjected to aseptic excision of a full-thickness wound on the dorsal thoracic area.

Experimental Design and Treatment Groups

Group I (Negative Control): Treated with ointment base (vehicle) only

Group II (Positive Control): Treated with penicillin ointment

Group III: Treated with 10% *R. phoenicis* oil ointment

Group IV: Treated with 20% *R. phoenicis* oil ointment

Group V: Treated with 30% *R. phoenicis* oil ointment

Topical application of respective treatments to the area of wound was done daily for a period of 10 days.

Assessment of Wound Healing.

Wound contraction was used to assess wound healing. Vernier caliper was used to measure the diameter of the wound area on days 0, 3, 7, and 10. The wound contraction percentage was computed in terms of wound size at the time of wound initiation.

The wounds were photographed at a given time in order to track the healing process.

Statistical Analysis

All data obtained were expressed in mean ± standard error of mean (SEM). The statistical analysis was conducted to compare the

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groups that were treated and the control group. A difference were considered statistically significant at $p < 0.05$.

Results

The effect of *Rhynchophorus phoenicis* oil was examined on wound healing by measuring contraction of the wound at 0, 3, 7 and 10 days after treatment. Day 0 showed no significant difference ($p > 0.05$) in the initial wound size in all of the experimental groups, indicating uniformity at baseline. By the 3rd day, a decrease in wound size was observed in all groups, including the control, positive control (penicillin ointment), and treatment groups (10, 20 and 30 percent *R. phoenicis* oil). However, there was no statistically significant difference ($p > 0.05$) between the treated groups and the control group. The same trend was noted on day 7 with progressive wound contraction being recorded in all the groups. Although this was reduced, statistical analysis revealed that there was no significant difference ($p > 0.05$) between the treatment groups and the control group. Significant wound closure was evident in all groups by day 10. But, the contraction of wounds in the 10%, 20% and 30% *R. phoenicis* oil were not significantly different ($p > 0.05$) compared to the control group. The statistically significant improvement ($p > 0.05$) was also not statistically significant when comparing the positive control group (penicillin ointment) to the control. Though wound contraction rose with time in all groups, wound healing at the concentrations of *Rhynchophorus phoenicis* oil in all treatments did not produce a statistically significant enhancement in wound healing when compared to the control.

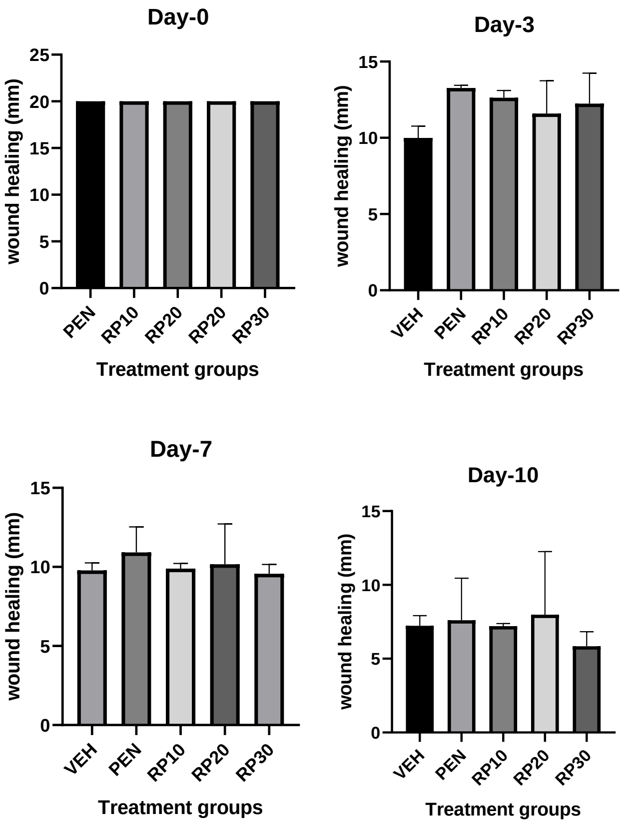
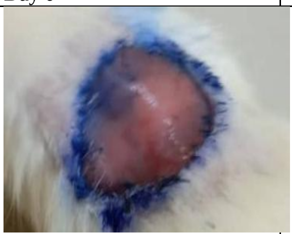
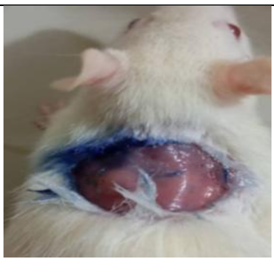
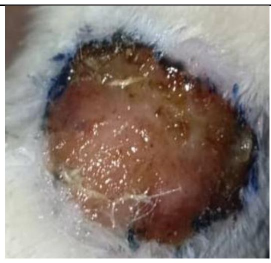
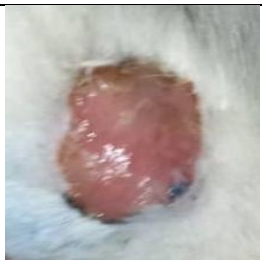


Figure 1: The impact of Rhynchophorus phoenicis oil on contraction of the wounds in Wistar rats in 10 days.

* Values are expressed as mean ± SEM (n = 4). No statistically significant difference was observed compared to the control group ($p > 0.05$).

Keys: VEH (Vehicle), PEN (Penicillin ointment), RP (*Rhynchophorus phoenicis*, 10 %, 20 and 30%)

Figure 2: Representative photographs showing wound healing progression in Wistar rats treated with vehicle (control), penicillin ointment, and *Rhynchophorus phoenicis* oil (10%, 20%, and 30%) on days 0, 3, 7, and 10.

Group	Day 0	Day 3	Day 7	Day 10
Control				
Positive control				
10% R.p oil				

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20% R.P oil				
30% R.p				

DISCUSSION

The present study evaluated the wound healing potential of *Rhynchophorus phoenicis* oil when used at the concentration of 10%, 20% and 30% using excision wound model in Wistar rats. The findings shows that at the end of days 3, 7 and 10, statistically significant difference ($p > 0.05$) was not observed among the treated groups and the control group in terms of wound contraction. This indicates that the oil at the concentrations tested did not have significant effects on wound healing as compared to the base formulation.

Although *R. phoenicis* oil is known to have such beneficial effects as fatty acids and vitamin E, which have antioxidant and anti-inflammatory effects, the latter did not manifest themselves evidently in the results of this study. Vitamin E is also reported to enhance wound healing through the decrease of oxidative stress and tissue repair (Vaiksen et al., 2022). However, the lack of significant improvement was observed in this study may be indicate that the concentration of active components was not enough, or the bioavailability of these components in the created ointment was low.

Interestingly, even the usual treatment (penicillin ointment) did not demonstrate significant difference as compared to the control group. This unexpected finding implies that the ointment base maybe composed of cetostearyl alcohol, wool fat, hard paraffin and soft paraffin that could have played a role in wound healing. These are known to keep the wound surface moist, shielded, and provide a beneficial environment that supports the healing of tissue (Somkuwar et al., 2024). Consequently, they may have masked any additional benefit from the active treatments.

The results of this study are not in line with the previous reports, Ojha et al., (2024), which suggest that fatty acids such as palmitic and linoleic acids oils may promote wound healing. On the same note, Wang et al., (2024) emphasized the importance of fatty acids in healing skin and alleviating inflammation. The variation in results could be as a result of difference in experimental design, formulation, concentration or mode of application.

The findings suggest that under the circumstances of this study, *Rhynchophorus phoenicis* oil failed to yield a meaningful wound healing effect. Future research needs to work on the best formulation, raising the concentration of the oil, or isolating active constituents and may do further research to understand its therapeutic potential better. Further study on its impact on tissue repair could be more revealing due to longer time of study and the addition of the histological analysis.

Conclusion

R phoenicis does not significantly enhances wound healing compared to control at concentration of 10%, 20%, and 30% . the control which consist of Cetostearyl alcohol, wool fat, hard paraffin, soft paraffin could be responsible why there is no significant difference between the samples, positive when compared to negative control.

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