

## Original Article

# Histopathophysiology Revisions the Induced Eczema in Albino Rats That Treated With Lanolin and Glycerin With Vaseline



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## ABSTRACT

**Background:** Anolin, also known as wool wax, is an oily product secreted by the sebaceous glands beneath the skin of sheep. It possesses anti-inflammatory, antimicrobial, and skin-protecting properties, making it a potential agent for treating skin conditions, such as eczema.

**Objectives:** This study evaluates the healing efficacy of lanolin in an experimental model of eczema induced in albino rats. The primary objective of this study is to assess the potent healing role of lanolin compared to glycerin in the treatment of acetone-induced eczema in albino rats. Specific aims include evaluating histopathological changes and measuring the reduction in inflammatory cells in the treated skin.

**Methods:** A total of 48 mature albino rats (weighing 250-350 g) were randomly assigned to two groups, namely a control group and an eczema group induced by applying 99.9% pure acetone to shaved skin using cotton swabs. After three days of acetone application, the eczema group was further divided into two equal subgroups (16 rats each), treated with either glycerin or lanolin. After 24 h, five rats from each subgroup were sacrificed for initial assessment. The remaining rats continued their respective treatments for an additional 72 h before being sacrificed on the third day. Histopathological analysis was conducted to compare tissue sections of eczematous skin with control sections, focusing on changes in the epidermal layer, the presence of fissures and cracks, aggregation of inflammatory cells, keratinization, and skin color changes.

**Results:** Histopathological examination revealed significant changes in the eczematous skin compared to control sections. These included noticeable thickening and elongation of the outermost skin layer, fissures, cracks in the epidermal layer due to skin dryness, and an aggregation of inflammatory cells. Additionally, keratinization of the epithelial layer and changes in skin color were observed. After 72 h of treatment, the lanolin group exhibited optimal healing effects compared to the glycerin group. The outermost layer of the skin returned to its normal length, and there was a marked decrease in the number of inflammatory cells in the lanolin-treated group.

**Conclusion:** Lanolin has a superior healing effect compared to glycerin in the treatment of acetone-induced eczema in albino rats. Lanolin effectively restored the skin's outermost layer to its normal length and significantly reduced the number of inflammatory cells, highlighting its potential as a therapeutic agent for eczema.

**Keywords:** Lanolin, Wool wax, Sebaceous glands, Anti-inflammatory, Antimicrobial

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## Introduction

**L**anolin or wool wax, wool yolk, and wool grease, is an oily product secreted by the sebaceous glands beneath the skin of sheep. The lanolin is an agricultural complex obtained from sheep wool. Based on the findings from two millennia ago, it is a yellow to pale brown color. It has an oily/creamy texture (Wang et al., 2022). The lanolin can be used in several technical applications; it can be used by the pharmaceutical industry and in cosmetic products specifically lanolin derivatives as well as in personal care and industrial sections. The lanolin is for topical uses only (Nozimoto et al., 2024). It can absorb more than 200% of its weight in water. Lanolin has emollient, anti-inflammatory, anti-microbial, barrier-repair, and skin-protecting properties. It has an effective moisturizing property with a long history of beneficial use and is safe in topical preparations; moreover, the lanolin creates an air-permeable barrier and promotes moist wound healing when applied to injured skin, and promotes moist wound healing and creates an air-permeable barrier when applied to the eczematous hand. It has antimicrobial, anti-inflammatory, barrier repair, and skin-protecting properties (Yüksel et al., 2021).

## Materials and Methods

A total of 48 mature male albino rats weighing 250 to 350 g were obtained from medicine laboratories (Department of Physiology and Pharmacology, Faculty of Veterinary Medicine, University of Kufa, Kufa, Iraq). The animals were housed in clean plastic cages (4 animals per cage) and kept in well-ventilated conditions under controlled temperature (between 23 °C and 25 °C) and 12 h light/dark cycle (light between 07:00 and 19:00). Food and water were freely available. Animals were fed with commercial food from the manufacturer Green World Company. During the lab work in the lab animal house, they used a lab coat, gloves, and a face mask which is surgical disposable, the rats were in a sterile surgical area, and they were anesthetized with ketamine-xylazine mixture (0.1 mL) for each rat by intramuscular injection with insulin syringe, after 5 min use the permanent marker to border the shaving area, and then the hair on their dorsal area was shaved. Shaving was done with a Braun shaving machine and then with a Venus shaving Razor followed by a soft hair removing cream. We soaked the cotton with 99.9% pure acetone and put it on the skin for 5 min for 3 days consequently to induce eczema according to Zhou and Sui (2019). The use of acetone because of

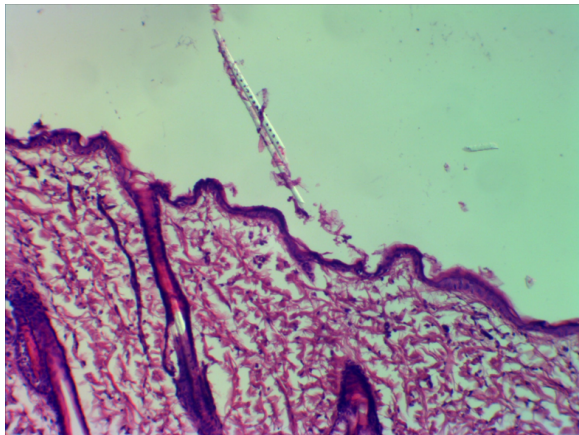
the acetone principle works on the skin is an alteration to the cutaneous barrier of the skin. We applied lanolin on the third group of rats after 72 h, and then glycerin on the fourth group after 72 h. They took the constant weight of jelly vaseline from Unilever Company. Pure fluid glycerin with electronic balance then dissolved the vaseline in a water bath in flask at 50 °C for 30 min. We used a spoon to mix the mixture and then put the mix in a large container (400 mL) and covered it with perfume to prevent oxidation, until further use which was the next day to treat the induced eczema (Alonso et al., 2020). Histopathological study of the organ (skin) was fixed in 10% formalin directly until the study. The experiment rats that were sacrificed specimens from the organ were enucleated immediately and tissue samples were taken from the organ and fixed in 10% buffered formalin for 48 h at room temperature. After fixation, the tissues were dehydrated in a grade of alcohol concentration then cleared in two stages of xylene and embedded in liquid paraffin for 2 h at 56 °C. The sectioning of tissue was done at 5 µm by microtome. Finally, they were dewaxed and stained with Harris hematoxylin and Eosin stain. The section tissues were examined using X10 and X40 objectives of light microscopy (Lachapelle et al., 2021).

## Results

The histological examination of the skin shows the changes that occurred in the dermal tissue of rats that have induced eczema by acetone as keratinized, dry, and inflamed skin. There is edema space in tissue parenchyma with blood vessel congestion and aggregation of inflammatory cells with hyperemia of tissue parenchyma. Additionally, the histological examination demonstrates the changes that occurred after treatment application of four groups of rats (Figures 1, 2, 3, 4, 5, and 6).

## Discussion

Histopathological control group analysis revealed normal skin with normal squamous epithelium and a fibroblastic connective tissue layer, according to histopathological evaluation (Kazemi et al., 2020). The eczematous skin indicates acetone-induced damage showing the apparent thickness and enlargement in the length of the outermost layer of skin because of the effect of acetone which destroys the profilaggrin protein leading to a defect in the skin barrier and increases in trans-epidermal water loss leading to dryness, as well as aggregation of inflammatory cells (Alhumidi et al., 2022). Also, there are fissures and cracks in the epidermal layer due to the dryness of the skin as well as edema beneath the dermal layer, keratinization of the epithelial layer, and changes



**Figure 1.** The histopathological section of skin in normal adult rat (control group)

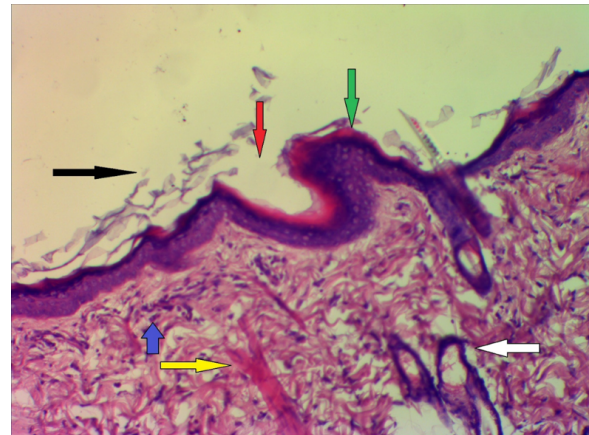
Notes: The figure shows the normal squamous epithelium (epidermis) and a fibroblastic connective tissue layer (dermis). The hair follicle also shows up in this section. The tissue is stained with hematoxylin and eosin stain (X10).

in skin color to brownish color (Rao et al., 2018). The histopathological sections were stained with hematoxylin and eosin stain of skin in adult rats treated with glycerin after 24 h of eczema. It showed a little area of peeling of the keratinization layer by the activity of glycerin (Park et al., 2017). The histopathological section of skin treated with glycerin after 72 h of eczema showed a very thin layer in the epidermis thinner than the normal because of the peeling effect of glycerin. The results showed that glycerin has a peeling effect on the epidermal layer of skin (Alfhili et al., 2019). Histopathological sections of



**Figure 3.** The histopathological section of skin in adult rat treated with glycerin after 24 h of eczema

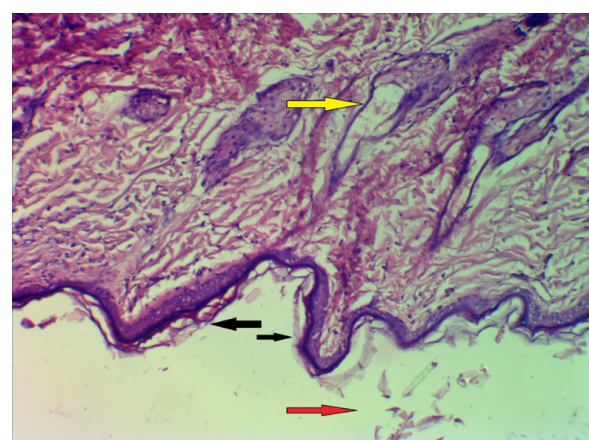
Notes: The figure shows a little area of peeling of the keratinization layer by the activity of glycerin (red arrow) and some droplets of glycerin fluid that have been absorbed by the skin (green arrows). However, there are no significant changes in the eczema group. The tissue is stained with hematoxylin and eosin stain (X10).



**Figure 2.** The histopathological section of skin in rat with eczema which is induced by acetone (eczema group)

Notes: The figure shows the apparent thickness and enlargement in the length of the outermost layer of skin (green arrow). Also, there are fissures and cracks in the epidermal layer due to the dryness of the skin (red arrow), in addition to edema beneath the dermal layer (white arrow). The section also shows hemorrhagic area (yellow arrow) aggregation of inflammatory cells (blue arrow) keratinization of the epithelial layer (black arrow) and changes in skin color to brownish. The tissue is stained with hematoxylin and eosin stain (X10).

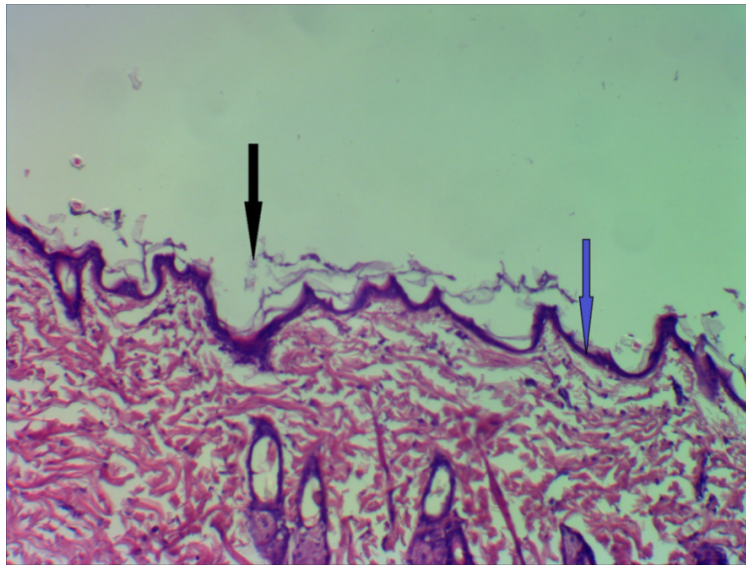
skin in adult rats that were treated with lanolin after 24 h of eczema showed a slight change in the epidermal layer as a decrease in the length of the layer, because the anti-inflammatory effect of lanolin (Alhumidi et al., 2022), as well as slight peeling of the keratinization layer. The tissue is stained with hematoxylin and eosin stains (Sharma



**Figure 4.** The histopathological section of skin in adult rat treated with lanolin after 24 h of eczema

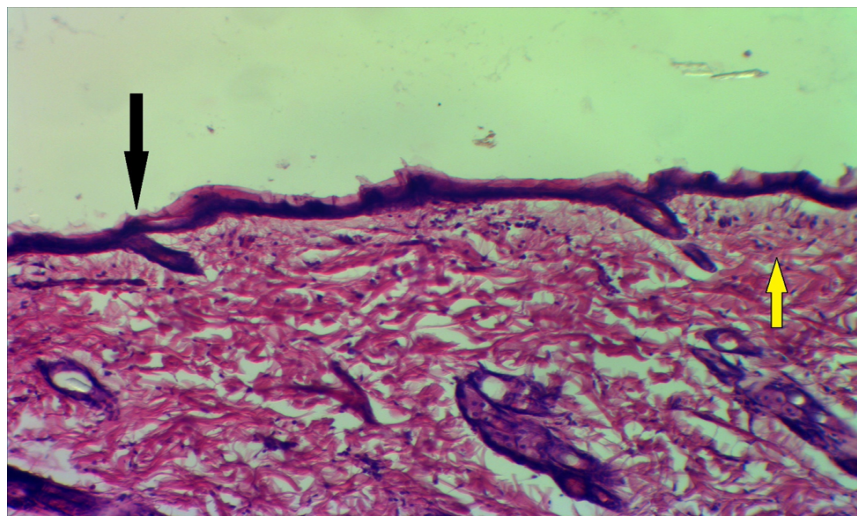
Notes: The figure shows a slight change in the epidermal layer as a decrease in the length of the layer (black arrows) and slight peeling of the keratinization layer (red arrow). However, there is still edema (yellow arrow). The tissue is stained with hematoxylin and eosin stain (X10).





**Figure 5.** The histopathological section of skin in adult rat treated with glycerin after 72 h of eczema

Notes: The figure shows a very thin layer in the epidermis thinner than normal because of the peeling effect of glycerin (blue arrow) and there is a lot of peeling area (black arrow) but still not treated well. The tissue is stained with hematoxylin and eosin stain (X10).



**Figure 6.** The histopathological section of skin in adult rat treated with lanolin after 72 h of eczema

Notes: The figure shows the return of the outermost layer of the skin to its normal length (black arrow) and a decrease in inflammatory cell number (yellow arrow). The skin almost returns to its normal situation. The tissue is stained with hematoxylin and eosin stain (X10).

et al., 2018), the histopathological section of skin in adult rats that were treated with lanolin after 72 h of eczema showed back the outermost layer of the skin to its normal length and decreased in inflammatory cell number, by the effect of anti-inflammatory lanolin as well as skin reconstructive and repair of skin fissures and cracks (Sprague et al., 2020). Also, there was a decrease in trans-epidermal water loss because of the moisturizing effect of lanolin (Alonso et al., 2020), the skin almost return to its normal situation (Nazarko et al., 2020).

## Ethical Considerations

### Compliance with ethical guidelines

This study was approved by the Ethics Committee of the University of Kufa, Kufa, Iraq (Code: 2019-23).

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## Conflict of interest

The author declared no conflict of interest.

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