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BENEFICIAL WOUND HEALING EFFECT OF B-GLUCANS + *BUCHANANIA LANZAN* EXTRACT IN ALBINO RATS

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ABSTRACT

In albino rats, the effect of an alcoholic extract of *Buchananialanzan (Buchanania lanzan)* alone and in combination on wound healing was investigated. In this study, incision and excision wounds were used as wound models. Breaking strength was measured in incision wounds, whereas epithelialization and wound contraction were measured in excision wounds. A substantial (P<0.001) difference was found in the dexamethasone-treated group. In the incision wound model, the extract of *Buchanania lanzan* a lone and its combination considerably increased wound breaking strength when compared to control (P<0.001). In comparison to control wounds, the combination treated wounds showed signifiantly increased (P<0.001) faster epithelialization and wound contraction rate. The use of *Buchanania lanzan* +β-glucans in the topical therapy of wound healing are supported by increased wound contraction and tensile strength.

KEYWORDS

Buchananialanzan, Wound contraction, Wound breaking strength and β-glucan.

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INTRODUCTION

A wound is a break in the normal tissue that causes cellular and molecular consequences. For many years, the basic principles of effective wound healing have been established, including minimising tissue injury, debriding non-viable tissue, increasing tissue perfusion and oxygenation, adequate nutrition and a wet wound healing

environment[1]. Herbal medicines are an essential component of traditional medicine. The rhizome of *Buchanania lanzan* is used as an expectorant, diuretic and carminative in traditional medicine[2]. It also has anticancer[3], antihypertensive and larvicidal propertie[4]. It is used to treat a variety of skin conditions, rheumatism and diabetes mellitus[5,6].

The biological response modifier β-glucan, whether particulate or soluble, has been found to improve immune functions by acting as an anti-infective, anti-tumor and immunomodulatory agent. Dermatology, particularly wound treatment, is one promising field of β-glucan application[7]. The activation of immunological and cutaneous cells by β-glucan molecules promotes moist wound healing and repair. Homeostasis, re-epithelization, granulation, tissue creation and extracellular matrix remodelling are all part of the wound healing process[8]. As a result, a multi-modal therapeutic method may help the wound heal faster. The purpose of this study is to determine the effect of β-glucan in increasing *Buchanania lanzan* wound healing activity.

MATERIAL AND METHODS

Collection and preparation of alcoholic extract of *Buchanania lanzan*

The shade dried fruits of *Buchanania lanzan* plants were crushed into small bits and powdered. The powder was placed into a Soxhlet extractor in 8 batches of 250g each and extracted for 30-40 hours with 95 percent ethanol. The extract was concentrated under decreased pressure on a water bath at a temperature below 50ºC to a syrupy consistency after the solvent was distilled out. It was then dried in a desiccator.

Animal care and Handling

They were kept in a controlled environment with a temperature of 23ºC, a humidity of 50%, and 10-14 hours of light and dark cycles, respectively. Throughout the trial, the animals were housed separately in polypropylene cages with rice husk (procured locally) as bedding and had free access to sterile food (animal chow) and water. Animals were carefully monitored for signs of infection and those that showed signs of infection were removed from the trial and replaced. The treatment was carried out in accordance with the consent of King Khalid University's animal ethics committee and the National Institute of Health's guidelines for the care and use of laboratory animals in the United States (NIH Publication No. 85-23, revised 1996).

Through an intragastric tube, Group I got 2ml of gum acacia 2%. *Buchanania lanzan*, 300mg/kg po, was given to Group II. *Buchanania lanzan* (300mg/kg) po + β-glucans 80mg/kg were given to Group III. The alcoholic extract of *Buchanania lanzan* was suspended in a 2 percent gum acacia solution.

Dosing Schedule

In the incision wound models, *Buchanania lanzan* extract alone and in combination with β-glucans were given orally once daily from day 0 to day 9; in the excision wound model, from day 0 to the day of full healing or the 21st postoperative day, whichever came first.

Wound models

All wounding procedures were carried out under pentobarbitone (3mg/100g) anaesthesia. In the present study no animal showed visible signs of infection.

Incision wound

Two paravertebral incisions of 6cm length were made on the depilated backs of the animals, cutting through the complete thickness of the skin. To approximate the cut edges of the skin, interrupted sutures were inserted 1cm apart[9]. On the seventh post-wound day, the sutures were repositioned and skin breaking strength was assessed using Lee's continuous water flow technique on the tenth day[10].

Excision wound

On the depilated back of the rat, an excision wound was inflicted by cutting away 500mm 2 complete thickness of a pre-determined area. The number of days after injury that the dead tissue had to break off and leave no raw wound was recorded as the epithelialization time. On alternate days, planimetric measurement of the wound area was used to track the pace of wound contraction. The wound was traced on graph paper to create this. The

wound area reduction was expressed as a percentage of the original wound size[11].

Statistical analysis

Results, expressed as mean ± SD were evaluated using Student's t-test and significance was set at ($p < 0.05$).

RESULTS AND DISCUSSION

Table No.1 shows the average breaking strength. The breaking strength of *Buchanania lanzan* co-administered with β-glucan was significantly increased ($p<0.001$).

Table No.2 shows the percentage of wound contraction measured on the 1st, 5th and 15th days in the control group. We found a positive trend in wound contraction rate in the *Buchanania lanzan* + β-glucan treatment group ($p<0.001$) and a negative trend in the control group ($p<0.001$).

Discussion

Granulation, collagen maturation and scar formation are only a few of the many wound healing phases that occur simultaneously but independently. The wound breaking strength is regulated by the rate of collagen production and, more importantly, by the maturation process, which involves covalent binding of collagen fibrils by inter and intra molecular cross linking. The process of mobilising good skin around the wound to cover the denuded region is known as wound contraction.

The activity of myofibroblasts is thought to be responsible for the centripetal movement of the wound margin[12]. Because *Buchanania lanzan* improved wound contraction, it either improved myofibroblast contractile properties or increased the amount of myofibroblasts recruited into the wound area. *Buchanania lanzan* significantly accelerated epithelialization in an excision wound model and co-administration of *Buchanania lanzan* with β-glucan accelerated epithelialization. Even if it was only for a short time, the activity of myofibroblasts is thought to be responsible for the centripetal movement of the wound margin. We saw a good trend in the early stages of *Buchanania lanzan* showing a considerable rise in wound contraction. On the 15th day, concomitant administration of *Buchanania lanzan* and β-glucan had considerably enhanced wound contraction. As a result, the preceding studies suggest that *Buchanania lanzan* has a prohealing impact. It also appears that *Buchanania lanzan* was able to increase epithelialization by either enhancing epithelial cell proliferation or enhancing epithelial cell survival.

β-glucans have a wide range of biological activities that improve human immunity. The use of β-glucans for topical treatments is on the rise. During wound healing, the main target cells of β-glucans are macrophages, keratinocytes and fibroblasts. B-glucans aid wound healing by promoting macrophage infiltration, which promotes tissue granulation, collagen deposition and re-epithelialization. β-glucan wound dressings are a good wound healer because they are stable and resistant to wound proteases[13].

Based on the properties of *Buchanania lanzan* and β-glucans, combining the two in a multi-modal treatment method considerably improved wound healing. This improved wound contraction and epithelization effect of *Buchanania lanzan* could be used clinically in the healing of open wounds. However, a well-designed clinical assessment will be required to confirm this suggestion.

Table No.1: Wound healing effect of *Buchanania lanzan*+ β-glucansin Incision wound model

S.No	Parameter	Placebo control	*Buchanania lanzan*	*Buchanania lanzan*+ β-glucans
1	Skin breaking strength (g)	313.13± 3.27	42.0 ± 4.48**	467.0 ± 4.47**

N = 6, Values are expressed as mean ± SD
**p* < 0.05 and **p < 0.001 vs. control. Independent *t*-test.

Table No.2: Wound healing effect of *Buchanania lanzan*+ β-glucansin excision wound model

S.No	Parameter	Placebo control	*Buchanania lanzan*	*Buchanania lanzan*+ β-glucans
Wound area (mm^2):				
1	Day 1	224.3±24.80	242.50 ± 12.7	235.50 ± 14.7
2	Day 5	181.6 ± 22.7	182.16 ± 31.56	172.17 ± 33.59
3	Day 15	128.8±25.81	64.41 ± 23.9 **	62.40 ± 24.8 **
4	Period of epithelialization (day)	15.7 ± 0.10	12.21 ± 0.14**	10.21 ± 0.14**

N = 6, Values are expressed as mean ± SD
**P < 0.001 vs. control. Independent *t*-test

CONCLUSION

In this investigation, an ethanol extract of *Buchanania lanzan* +β-glucan was shown to have characteristics that make it capable of stimulating rapid wound healing activity when compared to placebo controls. Wound contraction and enhanced tensile strength necessitate additional research into the topical therapy and management of wounds using *Buchanania lanzan* +β-glucans.

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CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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