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COMPARATIVE HEALING EFFICACY OF ACACIA PODS AND DERMAZINE CREAM ON BURN WOUNDS CREATED ON WISTAR ALBINO RAT

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ABSTRACT

Acacia nilotica has been widely recognized in traditional medicine for its wound healing and anti-inflammatory properties. This study aimed to evaluate the therapeutic efficacy of acacia nilotica administered topical, oral, and combined oral and topical routes in burn-induced albino rats. The Sumitra and Nidhi (2013) method was followed. Rats were given morphine I.P (0.02 mg/kg). Wounds were cleaned with saline and treated every three days with acacia 2% v/w oral, 2g/kg topical and combined 2% oral, 2g/kg topical. Treatment effects were compared with Dermazine, negative control (untreated burns), positive control (no injury). Changes in body weight, wound size over time, liver function tests (AST, ALT, ALP, TP, ALB, TB and DB), and malondialdehyde were assessed. Data were analyzed using one-way ANOVA with significance set at $p < 0.05$. The combination group (S+D) demonstrated significant improvement in wound contraction by Day 5 (3.10±1.10 mm^2) as shown in table 1, increased body weight when compared the reference Dermazine (193.67±1.48 to 178.67±1.40[a]) and the negative control from day 0 to day 14 (187.33±1.38 to 160.66±2.02) respectively as shown in table 2, and restored liver enzyme levels compared to controls. Additionally, MDA levels were lowest in the S+D group (101.06±1.56 nmol/L), indicating reduced oxidative stress. All Acacia-treated groups showed better outcomes than Dermazine, with the S+D route showing the most notable effects. Acacia nilotica extract, especially when administered both orally and topically, significantly enhances burn wound healing, supports liver function recovery, and reduces oxidative stress. These findings validate traditional use of acacia and highlight its potential as a natural alternative in burn wound therapy.

Keywords: Acacia, Dermazine, Liver, Antioxidant, MDA, LFT, Body weight, Wound size

INTRODUCTION

The use of topical chemotherapy has been fundamental in that regard and has helped to improve the survival of patients with major burns and to minimize the incidence of burn wound sepsis, a leading cause of mortality and morbidity in these patients (Fraser *et* al., 2004). Burns are an injury to the skin or other organic tissue primarily caused by heat or due to radiation, radioactivity, electricity, friction or contact with chemicals. Thermal (heat) burns occur when some or all the cells in the skin or other tissues are destroyed by hot liquids (scalds), hot solids (contact burns) and flames (flame burns). Burns are a global public health problem, accounting for an estimated 180 000 deaths (WHO, 2023). The majority of these occur in low- and middle-income countries and almost two thirds occur in the WHO African and South-East Asia Regions.

In many high-income countries, burn death rates have been decreasing, and the rate of child deaths from burns is currently over 7 times higher in low- and middle-income countries than in high-income countries (WHO, 2023).

Wounds are defined as physical, chemical, or thermal injuries that result in an opening or breaking in the integrity of the skin or the disruption of the anatomical and functional integrity of living tissues (Mohammed *et* al., 2025). The final aim of burn management and therapy is wound healing and epithelization as soon as possible in order to prevent infection and to reduce functional and aesthetic after effects (Salas *et* al., 2005).

Currently, extract-derived plants products have shown to facilitate wound healing, either through accelerating re-epithelialization, reducing the incidence of in situ inflammation, facilitating proliferation of fibroblast and angiogenesis. Plant extracts have shown effective combined mentioned pathophysiological effects on wound healing (Salehi *et al.,* 2019).The advantages of plant extract include their easy access, being cheap and having limited side effects. Various pharmacological effects, including modulation of angiogenesis, negative modulation of inflammatory cytokines release, and stimulation of antioxidant enzymes to reduce oxidative stress, are involved in wound healing processes depending on the phytochemical properties of the extract (Hajialyani *et* al*.,* 2018).

Wound healing management through the use of medicinal plants is a common practice in most traditional climes where situations of both acute and chronic wounds are treated with herbal preparation of all kinds. Thus, it is a known fact that Traditional Medicine, being a significant element in cultural patrimony, still remains the main resource for a large majority of people for treating health problems, and this is why the statement by the World Health Organization (WHO) that approximately 80% of the world's population depends on Traditional Medicine for their health care needs still remains valid. Consequently, it is on the foregoing background issues that the wound healing activity of A.nilotica becomes a suitable gap to explore, owing to its numerous cited and documented folklore claims as being used as a wound healing medicine.

Several studies have investigated the wound healing potential of *Acacia nilotica* (formerly known as *Vachellia nilotica*) in albino rats, particularly focusing on its pods and bark. These studies highlight the plant's efficacy in promoting burn wound healing through various mechanisms, (Sharma *et* al., 2020).

A study published in the *Journal of Pharmacy and Nutrition Sciences* evaluated the topical application of a hydro-ethanolic extract of *Acacia nilotica* pods on second-degree cutaneous infected burns in rats. The results indicated significant wound contraction and histological improvements, including enhanced granulation tissue formation, fibroblast proliferation, and neoangiogenesis. These effects were

attributed to the presence of tannins, flavonoids, alkaloids, and proteins in the extract, (Rafi *et* al., 2022).

Another study highlighted in the *Journal of Pharmacy and Nutrition Sciences assessed* the topical application of *Acacia nilotica* pods on burn wounds in rats. The findings demonstrated significant wound contraction and histological improvements, including enhanced granulation tissue formation and increased fibroblast and blood vessel proliferation. These results underscore the potential of *Acacia nilotica* pods in accelerating burn wound healing, (Zaini *et* al., 2020).

Antioxidant and Antibacterial activity of Acacia: The bark extract demonstrated significant free radical scavenging activity (93.3%) and total antioxidant capacity, crucial for reducing oxidative stress in wounds (Riasat *et* al., 2024). Acacia nilotica extract exhibited strong antibacterial activity against pathogens like Staphylococcus aureus, which is vital for preventing infection in wounds (Metowogo *et* al., 2015).

Wound Healing Efficacy of Acacia: In Vivo studies showed the bark extract exhibit maximum wound contraction (98%) and rapid epitheliazation in animal models, including its effectiveness in promoting healing (Riasat *et* al., 2024).

High levels of total phenolic content (50.9 µg GAE/mg extract) were found in bark extracts, contributing to antioxidant activity (Riasat *et* al., 2024).

The bark extract also showed substantial flavonoid content (28.7 µg GAE/mg extract), enhancing its therapeutic potential (Riasat *et* al., 2024).

Tannins and Saponins in Acacia are known for their wound healing properties, promoting tissue regeneration and reducing inflammation, (Mathias *et* al., 2022).

Dermazine Cream

For centuries silver has been known to have bactericidal properties. As early as 1000 B.C., the antimicrobial properties of silver in rendering water potable were appreciated, (Moyer *et* al., 2020). It took many years for interest in silver (nitrate) to revive, under the stimulus of a publication by (Moyer *et* al., 2020).

Prior reported effects of silver (nitrate) on burn wounds were based primarily on clinical studies and observations. The toxicity of silver ions has not been an issue in burn care that has received much attention, (Poon *et* al., 2004). Extensive treatment of acute burn wounds with silver sulfadiazine (SSD), however, has recently raised concern about potential silver toxicity, (Lansdown *et* al., 2002).

MATERIALS AND METHODS

Chemicals, Materials and Reagents

Jungle honey (Birnin Kebbi State), Sodium alginate (HiMedia Laboratories, Mumbai, India). Xylazine hydrochloride (Malven medics Int'l ltd), ketamine hydrochloride (curamus helt ltd), povidone-iodine solution (Deshalom pharm. ltd), Nalgene metabolic cage (Ancare Corp., Bellmore, NY), Scalpel, forceps, needle holder, scissors, chromic catgut (4-0), and silk thread. Phosphate buffer, H_2O_2, Xanthine oxidase (to generate superoxide), NBT, Tetrazolium, Salt, DTNB, EDTA, Methionine, NBT (nitroblue tetrazolium), Riboflavin, Enzyme sample, Trichloroacetic acid (TCA), 20% w/v, Thiobarbituric acid (TBA), 0.67% w/v, Butanol or n-butanol:acetic acid mixture (15:1) – optional, Standard MDA or 1,1,3,3-tetramethoxypropane (TMP) Phosphate buffer saline (PBS), pH 7.4, Centrifuge tubes, spectrophotometer and water bath

Animals

Thirty (36) healthy, adult inbred albino rats of wistar strain of both sexes weighing 180–200g were used in this experimental study. They were housed in the animal house of the Umaru Ali Shinkafi Polytechnic, Sokoto State. The animals were provided free access to water and standard food housed under controlled conditions of temperature (23°C ± 2°C), humidity (50% ± 5%), and 10–14h of light and dark cycles until analysis. The study was carried out after obtaining clearance from the institutional animal ethics committee.

Plant Preparation and Extraction

Fresh pods of Acacia nilotica were collected from Madorawa village along Airport road Bodinga Local Government Area of Sokoto State, Nigeria around 5 pm in April 2024 with the help of a traditional healer. Taxonomic identification and authentication were confirmed by Malam Sirajo Abubakar of the Herbarium unit of the Department of Pharmacognosy and Ethnopharmacy, Usmanu Danfodiyo University, Sokoto. A plant sample voucher number PCG/UDUS/Faba/0011 was identified for the procured sample and referenced. The collected acacia pods were air dried for two weeks and later pulverized using mortar and pestle into coarse form. The powder was stored in an air-tight container until needed. Hundred grams (100g) of the powdered pods were weighed, soaked into 900ml beaker of distilled water and allowed to stand at room temperature for 3 days before the treatment begins

Table 1: Study Design

Group	Number of Rats	Description
Group 1	6	Healthy rats (control)
Group 2	6	Wounded rats, untreated
Group 3	6	Wounded rats treated with Dermazine cream
Group 4	6	Wounded rats treated with Acacia 2% v/w drink
Group 5	6	Wounded rats treated with Acacia 2 g/kg smear
Group 6	6	Wounded rats treated with Acacia 2% v/w drink+2g/kg smear

Surgical Procedure

The dorsums of all the study rats were shaved and the exposed skin scrubbed with Eusol solution. Following anesthesia with ketamine and xylazine plus, one circular skin wound of 10 mm diameter and full skin thickness of 3 mm, was made at their dorsums using a sterile hot iron rod.

Post-Surgery Care and Follow Up

The animals were monitored immediately postoperatively for spontaneous breathing efforts and movement. After surgery, each animal was housed in an individual cage in a room and fed with standard rat diet and water, post-operative subcutaneous injection of morphine0.02 mg/kg was administered. All wounds were cleaned with normal saline and acacia were reapplied every three days. All wounds were assessed clinically according to a scoring system. The rats were then humanely euthanized with an intra-peritoneal injection of 5mg phenobarbitone sodium.

Evaluation of Wound Size

The wounds were subjected to evaluation every three days, i.e., on day 3, 6, 9, 12, 15, 18 and 21. Each wound was examined and photographed after burn wound creation prior to complete healing. Clinical assessments including observations concerning the appearance, and the wound size was also measured using graph paper. The wound size was measured from the periphery of the wound.

Assessment of Wound Healing

Wound healing was assessed on various parameters including evaluation of wound surface, percentage of wound healing, duration of healing, and completes healing. Wound surface was evaluated as mm^2 unit on days 1, 5,10,15,20, and 25 after wound creation and the percentage of healing was normalized by the following formula:

Percentage healing% =Area on day zero (mm) − Area on day measurement (mm)/Area on day zero (mm) × 100
(Ofori-Kwakye *et* al*.,* 2009).

Statistical Analysis

Values were expressed as Mean ± Standard Error of the Mean (SEM). Data analysis was performed using Graph Pad Prism Statistical Software version 6.0 and was analyzed using ANOVA. A difference at $p<0.05$ was considered significant.

RESULTS AND DISCUSSION

Table 2: Body weight of the Albino Rats Following Treatment

Treatment Group	Day 0	Day 7	Day 14
Negative Control	187.33 ± 1.45	168.00 ± 1.73	160.66 ± 2.02
Positive Control	190.21 ± 1.38	195.00 ± 1.21	207.36 ± 1.90
Dermazine	193.67 ± 1.48	194.66 ± 1.33[a]	178.67 ± 1.40[a]
Acacia (S + D)	191.66 ± 1.93	197.00 ± 1.15[a]	208.66 ± 2.03[a]
Acacia (S)	194.33 ± 1.20	195.33 ± 1.20[a]	198.00 ± 1.15[a]
Acacia (D)	185.65 ± 1.45	187.34 ± 1.20[a]	189.33 ± 1.20[a,b]

Results are expressed as mean ± SD (n=6). [a]$p < 0.05$ significant by difference when compared with control, [b]$p < 0.05$ compared to dermazine, [ab]$p < 0.05$ compared to treatment, One-way ANOVA. S, smear; D, drink; S+D, smear and drink.

Table 3: Wound size on the Study Rats for the Period of 21 Days

Treatment Group	Day 0	Day5	Day 10	Day 15	Day 20
Negative Control	10.20±0.01	15.17±0.22	15.13±0.02	17.21±0.04	18.13±0.01
Dermazine	10.55±1.92	10.01±1.31[a]	10.21±1.42[a]	10.01±1.39[a]	15.02±1.31[a]
Acacia (S)	10.06±0.08	5.33±1.15[b]			
Acacia (D)	10.08±0.04	10.65±1.72[a]	10.03±1.61[a]	8.06±1.82[a]	7.05±1.99[ab]
Acacia (S+D)	10.04±0.08	3.10±1.10[b]			

Results are expressed as mean ± SD (n=6). [a]$p < 0.05$ significant by difference when compared with control, [b]$p < 0.05$ compared to dermazine, One-way ANOVA. S, smear; D, drink; S+D, smear and drink

Table 4: Effect of treatment on antioxidant enzymes

Treatment Group	GSH (mg/dL)	SOD (U/mL)	CAT (U/mL)
Control	66.77 ± 1.76	0.05 ± 0.004	0.21 ± 0.01
Dermazine	136.22 ± 2.72[a]	0.38 ± 0.039[a,c]	0.98 ± 0.04[a]
Acacia (S + D)	126.92 ± 2.13[a]	0.49 ± 0.040[a]	1.47 ± 0.05[a,c]
Acacia (S)	118.47 ± 2.40[a]	0.23 ± 0.012[a,b,c]	0.79 ± 0.03[a,c]
Acacia (D)	113.20 ± 2.20[a]	0.12 ± 0.017[a,b]	0.37 ± 0.01[a,b]

Results are expressed as mean ± SEM. [a]$p < 0.05$ significant by difference when compared with control, [b]$p < 0.05$ compared to dermazine, One-way ANOVA followed by Tukey's multiple comparison test. Smear (S) Drink (D), Smear and Drink (S+D).

Table 5: Showing The Effect of Acacia on Liver of the Subject Rats

Treatment	AST(IU/L)	ALT(IU/L)	ALP(IU/L)	TP(g/L)	ALB(g/L)	TB(mg/dL)	DB(mg/dL)
Positive Control	140.24 ± 1.12	40.33 ± 0.61	220.51±0.74	7.10±0.03	4.10±0.06	0.40±0.004	0.10±0.006
Negative Control	199.33 ± 2.02	97.66 ± 0.83	203.00±1.15	17.90±0.05	70.30 ± 0.12	1.81±0.002	0.91±0.008
Dermazine	83.33 ± 2.00[a]	41.33 ± 0.88[a]	113.33±0.88[a]	4.90±0.03[a]	32.07 ± 0.12[a]	0.16±0.008[a]	0.10 ± 0.005[a]
Acacia(S+D)	78.66 ± 1.76[a]	36.67 ± 0.79[a]	99.00±1.53[a,b]	3.90±0.11[a,b]	29.53± 0.08[a,b]	0.12±0.007[a]	0.08 ± 0.003[a]
Acacia (S)	90.67 ± 1.45[a]	49.56 ± 0.81[a,b]	114.00±1.15[a]	5.30±0.06[a,b]	33.83± 0.09[a,b]	0.19±0.012[a]	0.14 ± 0.007[a,b]
Acacia(D)	105.34 ± 2.01[a,b]	58.31± 0.80[a,b]	141.66±1.20[a,b]	6.27±0.12[a,b]	38.67± 0.12[a,b]	0.22±0.009[a]	0.18 ± 0.006[a,b]

Results are expressed as mean ± SEM.
[a]$p < 0.05$ significant by difference when compared with control, [b]$p < 0.05$ compared to dermazine, One-way ANOVA. Smear (S), Drink (D).

Table 6: Showing Lipid Peroxidation (MDA) Result for the Treatment Groups

Treatment Group	MDA (nmol/L)
Negative Control	96.03 ± 2.24
Positive Control	231.62 ± 2.23
Dermazine	119.22 ± 2.90[a]
Acacia (S+D)	101.06 ± 1.56[a]
Acacia (S)	114.74 ± 2.24[a]
Acacia (D)	118.99 ± 2.23[b]

Results are expressed as mean ± SEM. [a]$p<0.05$ significant by difference when compared with control, [b]$p < 0.05$ compared to dermazine, One-way ANOVA. Smear (S), Drink (D).

Discussion

This study evaluated the wound healing efficacy of Acacia nilotica pods powdered and aqueous extract applied topically, orally, and in combination on burn injuries in Wistar albino rats, while also examining its effects on liver function and oxidative stress markers. Phytochemical screening confirmed that Acacia contains key bioactive compounds—saponins, tannins, flavonoids, and polyphenols—that are known to possess anti-inflammatory, antioxidant, and antimicrobial properties (Sene *et* al., 2023). These constituents likely contribute to accelerate healing by enhancing re-epithelialization, angiogenesis, keratinocyte migration, and collagen formation.

Monitoring body weight in the rats provided an indirect assessment of systemic recovery. The untreated (negative control) group experienced significant weight loss over the 14-day period (from 187.33g to 160.66g), reflecting catabolic stress and poor healing outcomes as shown in Table 1. Conversely, the Dermazine-treated group (a standard reference therapy) maintained and slightly increased weight (from 193.67g to 178.67g); though recent literature questions its efficacy and highlights its potential cytotoxicity and delayed wound healing (Hussain et al., 2005).

The most notable improvement was observed in the *Acacia* (S+D) group, which showed the highest weight gain (191.66 to 208.66 g), surpassing both Dermazine and single-route treatments. This indicates that the combined topical and oral administration of *Acacia* offers synergistic benefits enhancing nutritional recovery, minimizing metabolic stress, and promoting systemic healing. Topical-only (S) and oral-only (D) treatments also yielded significant improvements in weight gain, though to a lesser extent, highlighting their individual therapeutic merit as shown in table 2.

Assessment of antioxidant enzyme activities provided insights into oxidative stress mitigation. Glutathione (GSH), a vital intracellular antioxidant, was significantly depleted in the control group (66.77 ± 1.76mg/dL), indicating high oxidative burden. All treated groups showed marked GSH restoration, with the highest levels in the Dermazine (136.22 ± 2.72) and *Acacia* (S+D) (126.92 ± 2.13) groups. This suggests both treatments confer systemic antioxidant support, with dual-route *Acacia* use proving comparably effective.

Superoxide dismutase (SOD) activity, another crucial antioxidant marker, was minimal in the control group (0.05 ± 0.01/mL) but increased significantly across all treated groups. The *Acacia* (S+D) group recorded the highest activity (0.49 ± 0.01U/mL), demonstrating strong free radical neutralization. Dermazine and topical *Acacia* also showed robust enhancement, affirming the efficacy of both treatment modalities. Catalase, which detoxifies hydrogen peroxide, followed a similar trend. The *Acacia* (S+D) group again had the highest catalase activity (1.47 ± 0.05 U/mL), followed by Dermazine (0.98 ± 0.04 U/mL), while the control group remained suppressed (0.21 ± 0.01 U/mL), confirming systemic oxidative stress in the untreated burns.

Liver function indices further illustrated the systemic impact of treatment. The control group exhibited elevated AST (199.33 U/L), ALT (97.66 U/L), and ALP (203 U/L), indicative of hepatic stress caused by burns. Treatment with *Acacia* (S+D) and Dermazine significantly reduced these enzymes, with *Acacia* demonstrating particularly effective hepatoprotection (AST: 78.66 U/L, ALT: 36.67 U/L, ALP: 99 U/L). These improvements suggest that both treatments not only support local healing but also counteract burn-induced systemic toxicity.

Interestingly, total protein (TP) and albumin levels were lower in the treated groups compared to the control (TP: 17.90 g/dL, Albumin: 70.30 g/dL), possibly reflecting a normalization of acute-phase response proteins and improved hepatic regulation. Elevated total bilirubin (TB) and direct bilirubin (DB) in the control group further confirmed hepatic dysfunction, while all treatments markedly reduced bilirubin levels. Again, the *Acacia* (S+D) group demonstrated the most profound effect (TB: 0.12 mg/dL, DB: 0.08 mg/dL), nearly matching Dermazine's performance.

Lipid peroxidation, measured by malondialdehyde (MDA) levels, provided a direct indicator of oxidative membrane damage. The control group had significantly elevated MDA (231.62 ± 2.23 nmol/L), while treatment with Dermazine reduced it to 119.22 ± 2.90 nmol/L. However, the *Acacia* (S+D) group showed the lowest MDA levels (101.06 ± 1.56 nmol/L), reinforcing its superior antioxidant capacity. Topical (S) and oral (D) *Acacia* groups also showed significant MDA reduction, underscoring their individual benefits.

CONCLUSION

The use of natural medicinal plants offers a safer and more affordable alternative means of treatment. This study confirms that Acacia nilotica pod extract especially when administered both topically and orally significantly enhances burn wound healing. It also promotes wound contraction, supports tissue repair, and improves systemic health outcomes as indicated by the treated animals. Overall, the findings validate the traditional use of Acacia nilotica in burn care and suggest it may offer advantages over standard treatments like Dermazine, including greater safety, broader availability and superior healing efficacy.

RECOMMENDATIONS

There is a need to develop standardized formulations by the pharmaceutical companies (both topical and oral) of Acacia nilotica with quantified active constituents to ensure consistent therapeutic outcomes as substitute to the conventional ones.

Comparative evaluations with other commonly used natural and synthetic agents will help to better position Acacia nilotica in the spectrum of available wound-healing therapies.

Pharmaceutical and cosmeceutical industries should explore the development of Acacia-based creams, gels, and oral supplements for use in burn management and other dermal injuries.

Wound Appearances

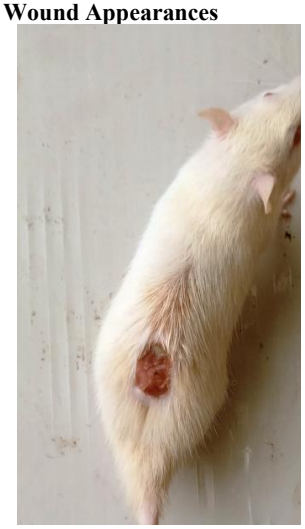

Figure 1: Acacia Drink (day 10)

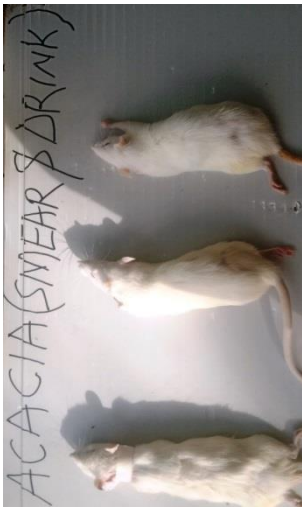

Figure 2: Acacia (S+D day 9)

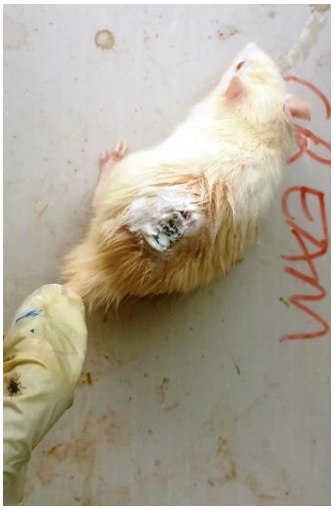

Figure 3: Dermazine (day 14)

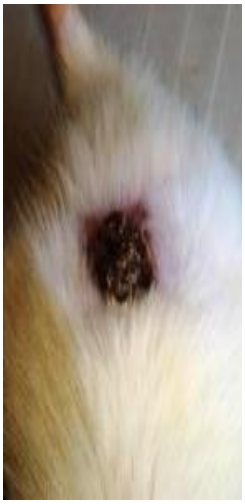

Figure 4: Acacia Smear (day 10)

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