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Therapeutic Efficacies of Turmeric Paste and Ash Ointment on Wound Healing in Black Bengal Goats

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Abstract

Across the Indian subcontinent, herbal remedies and other natural treatments are easily available for the treatment of farm animals. The study aimed to evaluate the therapeutic effectiveness of different materials that are historically used in Bangladesh to treat wounds. There were 36 incised wounds on the twelve Blank Bengal goats (three on each animal). Three groups of goats were used: Group A served as the control group, Group B received turmeric paste treatment, and Group C received cotton ash treatment. Data were collected on follow-up from the first postoperative day to the twenty-first. Additionally, morphological features such as wound swelling, the width of the sutured area, wound contractions, and the length of time the wound took to heal were recorded. On days 1, 4, and 8 of the operation, blood samples and tissue biopsies were collected for hematological and histological investigation. When comparing wounds treated with cotton ash to other groups, the contraction (0.27±0.01 mm), swelling of the suture area (0.37±0.03 mm), and elevation line of the suture (1.43±0.05 mm) were all lowest ($P<0.05$). According to histological investigations, on day eight of group B's wound, epithelial regeneration and healthy collagen fibers appear in the subcutis, whereas the keratin layer of epidermis appears thick and a huge accumulation of carbon particles beneath the muscularis layer in the wound treated with ash. We may conclude that goat skin lesions can be treated with cotton cloth ash in addition to other herbal medicines. Ash ointment and turmeric paste are both beneficial, but turmeric paste accelerates recovery more quickly.

Keywords: cotton ash; turmeric paste; wound healing; histopathology; goats

Introduction

The livestock subsector contributes roughly 1.90 percent of GDP [1]. The sales of premium leather account for about 4.00 percent of total export income [1]. Goat is one of the important livestock commodities of Bangladesh. Bangladesh's climate is warmer, which helps produce higher-quality leather, but many drawbacks, especially wound problems, outweigh these advantages [2]. Several potentially fatal consequences may arise from improper wound care. The complex biological process of wound healing requires coordinated physical, cellular, and molecular processes to restore the structural and functional integrity of wounded tissue [3, 4]. A variety of biomaterials, proteins, antibiotics, vitamins, and minerals manifests as an effective measure to promote angiogenesis, fibroblastosis, and wound epithelialization and speed up wound healing [5].

Nowadays, the use of plant-based antibacterial compounds has become popular to treat wounds due to their low cost and minimal side effects [6]. A number of studies have been conducted to find substances that can hasten wound healing with minimum treatment cost [7]. Herbal plants and other natural medicines are widely available across the Indian subcontinent. One of the most widely used herbal remedies is turmeric, which comes from the Curcuma longa plant's rhizomes and includes the organic compound curcumin [8]. Applying curcumin topically has been effective in healing cutaneous wounds. Moreover, it has been demonstrated that using curcumin expedites the healing of open wounds [9]. Curcumin speeds up the healing process by promoting the re-epithelialization and migration of cells such as myofibroblasts, fibroblasts, and macrophages [10]. Curcumin decreases pain and inflammation while also preserving homeostasis by blocking the arachidonic acid cascade via the lipoxygenase and cyclooxygenase (COX) pathways [11]. Nitric oxide is eliminated by curcumin, and it also inhibits COX-2, an inflammatory agent [9]. On the other hand, skin wound healing depends on the availability of trace elements in the proper combinations, which act as cofactors for enzymes and boost the structural elements in tissue repair. After examining several ashes, it was found that they have the precise metal composition required to speed up the healing process. As an antiseptic and antibacterial, using ashes offers comprehensive protection, assisting in the management of the proliferative period without requiring any extra effort. Compared to most topical treatments used today, applying ashes to a wound provides a natural, humid environment that speeds up the healing and repair process significantly [12].

Bangladeshi rural farmers have long used a range of plants and herbal remedies, along with inorganic materials like cotton ash, to cure skin lesions. Marigold leaves, turmeric, alovera, and ashes have all been used to treat wounds in goats, lambs, and rabbits [13-16]. They looked at the physical characteristics and histology of the wound. However, compare the medicinal efficacies of ash with those of the other herbal plants. Thus, the aim of the present study was to compare the therapeutic efficacy of ash and turmeric paste in the experimental incised wound healing of the goat. Moreover, the study would increase our understanding of the wound healing process and allow us to identify cost-effective wound healing therapies.

Materials and methods

Ethical statement

The experimental procedures performed in our study followed the ethics regulations and were approved by the Bangladesh Agricultural University (ref. no: AWEEC/BAU/2023 (28).

Study area and experimental animals

The study was conducted in the Department of Surgery and Obstetrics, Bangladesh Agricultural University, Mymensingh. Twelve apparently healthy Black Bengal Goats, purchased from the local market, were used for the experiment. The goats were allowed to feed and water ad libitum. Bran and concentrate were supplied to the goats in the late afternoon. All the experimental goats were dewormed with Fenbendazole @5mg/kg (Tab. Paraclear®, Techno Drugs Ltd) and Ivermectin @0.2mg/kg intramuscularly (inj A-Mectin®, ACME Laboratories Ltd). All goats were immunized against tetanus, administering tetanus toxoid (Tetanus toxoid®, Human Co. Ltd, Hungary) at the dose rate of 0.5 ml/goat intramuscularly prior to the experiment. All goats were vaccinated with PPR vaccine (Livestock Research Institute, Bangladesh) @1ml/goat intramuscularly. The animals were acclimatized to the changing environment and management system for 2 weeks before engaging to the experiment.

Preparation of turmeric paste

The fresh turmeric was bought from the local market. Then the turmeric was peeled off and washed. After that, chop it into small pieces and let it dry overnight in a hot air oven. Dried turmeric was powdered by a mechanical grinder, and a paste was prepared by adding distilled water.

Preparation of ash

The cotton clothes were collected from the nearby marketplace. Then the clothes were washed with distilled water and thoroughly burned to create ash. The ointment was prepared after mixing the ashes with petroleum jelly for topical application on the incised wound.

Experimental design

Twelve goats had a total of thirty-six surgical wounds made on their skin (3 wounds on each animal). Goats were divided into three groups, each including four animals.

Group A: This was the control group. Surgical wounds were dressed with normal saline.

Group B: Each animal received three localized applications of freshly produced turmeric paste for wounds on the skin.

Group C: Each animal had three skin wounds, to which ash was given topically every day.

Every animal was kept under strict care to prevent environmental influences, including humidity, rain, insects, and other illnesses. Avoiding antibiotics, antihistaminics, or anti-inflammatory medications was done to mitigate their impact on the healing process. From the day of the surgical procedure to day 28 following the procedure, follow-up data were kept.

Surgical wound formation

The abdominal region of the goat was shaved and cleaned with 10% Povidone Iodine solution (Povisep®, Beximco Pharmaceuticals, Bangladesh). After subcutaneous infiltration with 2% lidocaine HCL, a vertical incision was made in that area to create a surgical wound of 2 cm in length and 1 cm in depth. Blunt dissection was done to remove the skin from the underlying tissues. Every incision was sealed with a simple interrupted silk suture. Eight millimeters separated each stitch. There was a 5 mm gap between the needle position and the cutting edge's border. Three throw knots (Reinforced surgeon's knot) were used to close each wound.

Local treatment

According to the treatment protocol, ash was applied daily to the wound. Turmeric was also administered as a thin layer on the wounds once per day. These applications were repeated every day for eight days. Food was not withheld following surgery. The wounds in all groups were observed clinically every day. Sutures were removed on day 8 post-operation.

Observation of morphological changes

To assess how effectively the wounds were healing, morphological traits including the width of the sutured region (mm), the elevation of the sutured line from the skin surface (mm), the swelling area of the wound (mm), and wound contraction were measured. During suture removal, the elevation of the sutured line was recorded. Using slide callipers, the width of the sutured area was measured on the following days of the surgical intervention: day 0 (Do), day 3 (D3), day 8 (D7), day 14 (D14), and day 21 (D21) to determine the length of the wound contraction.

Assessment of wound healing

This procedure was carried out for four weeks after the creation of the surgical wound. Digital images of each wound were obtained

every three days during four weeks after the surgical wound formed, under close clinical observation. When visible epithelium covered a wound and cicatrization and pigmentation were observed, the wound was deemed to have healed.

Biopsy and histopathology

For a histopathological investigation, tissue samples were taken at D1, D4, and D8 from all treatment groups as well as the control group. The 1.5 cm x 1 cm samples were taken from each experimental animal's wound site. For more than seven days, the samples were preserved in a 10% phosphate-buffered formalin solution. The preparation of histopathological slides was done using Luna's (1968) approach [17]. A photomicroscope (Model: CX43, Olympus Corporation, Tokyo, Japan) was used to obtain histology photographs at different magnifications in order to better show the histological findings.

Statistical analysis

All data were presented as mean±SEM. Using SPSS software, a one-way ANOVA (Analysis of Variance) factor analysis was done to compare data between groups. Probabilities *P<0.01* and *P<0.05* were considered statistically significant.

Results

Morphological characteristics of skin wound

The morphological characteristics of wounds following the treatment protocol are presented in Table 1, Figures 1 and 2. All the parameters were compared to the control group (A) to find the level of significance. The wound contraction was significantly lower in Group C compared to the other groups. The healing score was excellent in both the wounds that were treated with turmeric and ash. But the healing score was fair in the wound of the control group. In comparison with group A, the progress of elevation line and swelling of wounds in groups B and C were highly significant.

Groups (n=12)	***Wound Contraction (mm)***		
	Day 3	***Day 8***	***Day 14***
Group A (n=4)	1.10 ± 0.04^{a}	3.04 ± 0.06^{a}	0.81 ± 0.12^{a}
Group B (n=4)	1.11 ± 0.01^{a}	3.03 ± 0.02^{a}	0.45 ± 0.04^{b}
Group C (n=4)	1.02 ± 0.04^{b}	2.47 ± 0.05^{b}	0.27 ± 0.01^{c}

a, b, c indicates significant (P<0.05) difference between groups.

Table 1: Effects of normal saline, turmeric, and ash on wound contraction in goats.

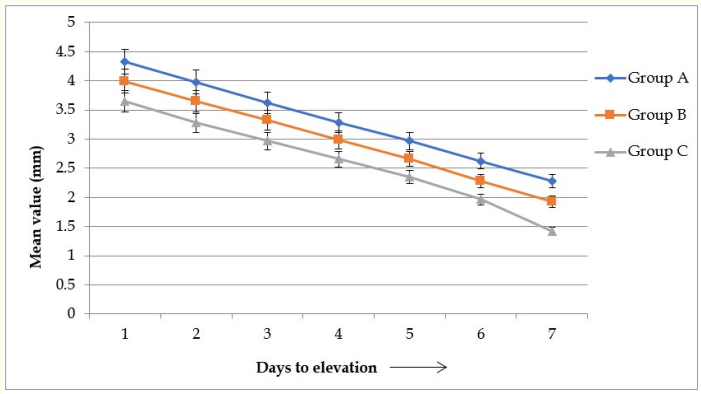

Figure 1: Progress of elevation line of wounds of three groups in 7 consecutive days.

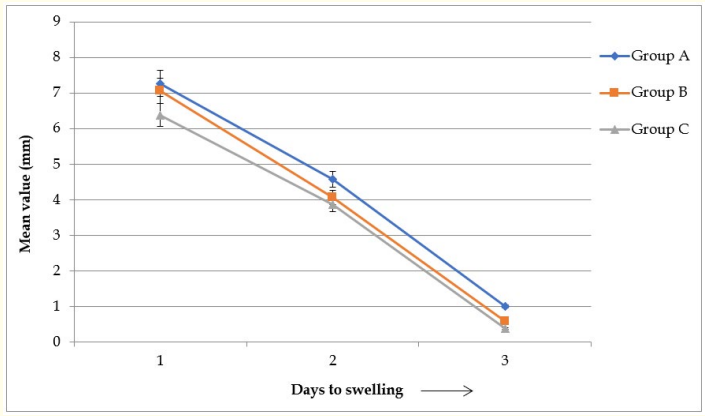

Figure 2: Progress of swelling of wounds of three groups in three consecutive days. Histopathological examination.

Histopathological changes of wounds of the control group and those treated with turmeric and ash at day 1 are presented in Figure 3. Huge infiltration and focal aggregation of inflammatory cells in the epidermis and subcutis in groups A, B, and C (arrowhead). Shortness of villi, sloughing of desquamation in epithelium in group A, B and C (arrow). Degeneration of collagen and reticular firber, more prominant in group C (Asteric).

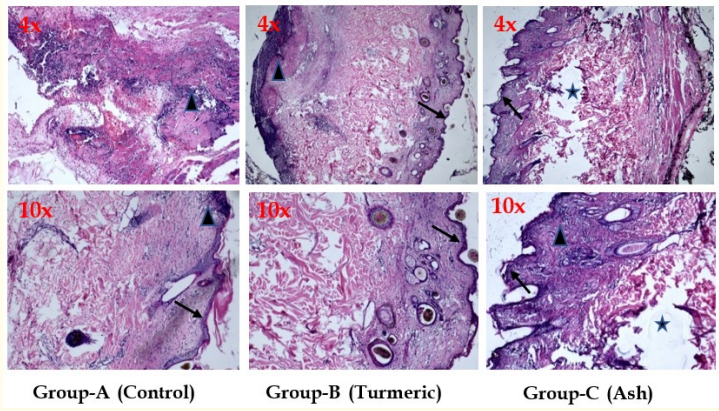

Figure 3: Histopathological changes at day 1 (4x and 10x object).

Histopathological changes of wounds of the control group and those treated with turmeric and ash at day 4 are presented in Figure 4. Few inflammatory infiltrations in the epidermis in groups A, B, and C (arrowhead). Huge inflammatory infiltration and aggregation in the subcutis in group C (arrowhead). Mild Proliferation of the epithelium (arrow) indicates regeneration in groups A and B. Almost all healthy collagen fibers appear in group B. Degeneration and loss of fiber in groups A and C.

Histopathological changes of wounds at day 8 are presented in Figure 5. Huge proliferation of the epithelium in groups A and C. Regenerating epithelium in group B. Normal appearance of epidermis, dermis, and subcutis in group B. Accumulation of carbon particles beneath muscuris layer in group C (orange arrow).

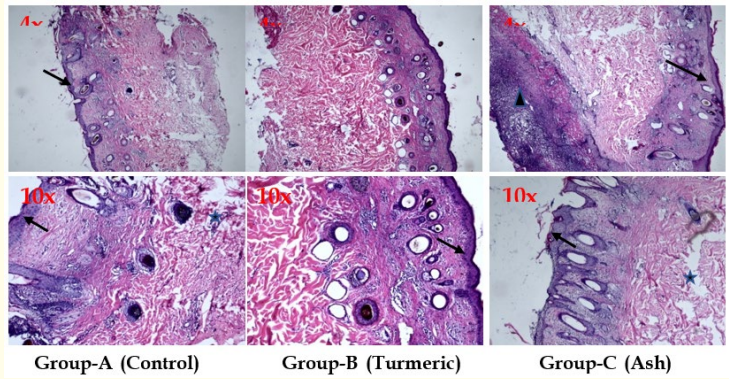

Figure 4: Histopathological changes in the wound at day 4 (4x and 10x object).

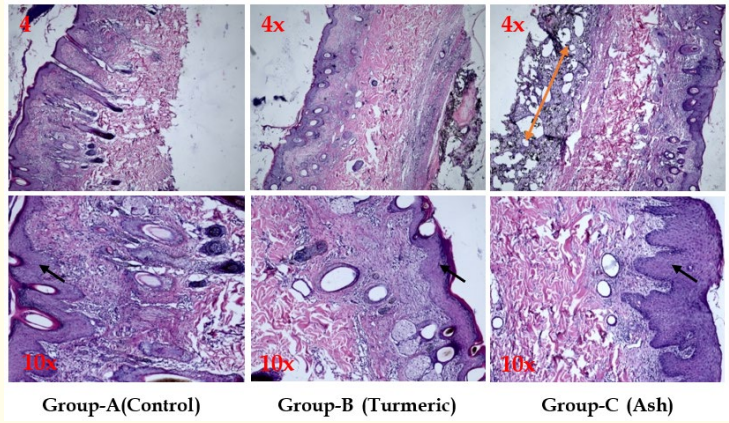

Figure 5: Histopathological changes in wounds at day 8 (4x and 10x object).

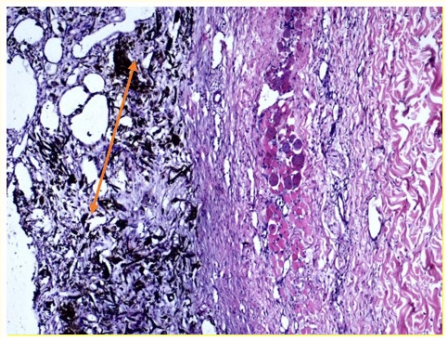

Figure 6: Huge accumulation of carbon particles in the subcutis in ash-treated wound at day 8.

Gross appearance of the wound

Wounds treated with turmeric and ash showed excellent recovery, as measured by the healing score scale. At days 18 through 21, wounds treated with ash and turmeric had contracted and fully healed, with hair follicle growth. While there was a noticeable scar formation on the wound surface in the control group. No dehiscence was seen in any of the three groups' wounds (Figures 7, 8, 9, and 10).

Figure 7: Gross appearance of wound in Group A, B and C at day 3.

Figure 8: Gross appearance of wound in Group A, B and C at day 8.

Figure 9: Gross appearance of wound in Group A, B and C at day 18.

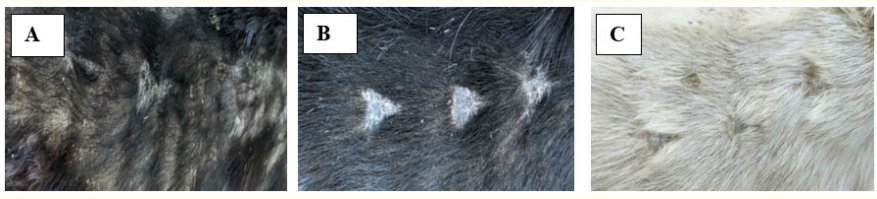

Figure 10: Gross appearance of wound in Group A, B and C at day 21.

Discussion

Traditional wound treatment includes the use of a variety of plant and herbal medicines to hasten the healing process. Few studies on the use of herbal medicines to speed wound healing have been conducted in Bangladesh. The application of topical medications is a technique for preventing wound contamination. In this study, the morphological and histological characteristics of the wounds were evaluated to determine the therapeutic efficacy of turmeric paste and ash ointment on the surgical wounds. The application of topical medications is a technique for preventing wound contamination. The research's conclusions draw attention to the distinctions and importance of choosing the right topical therapy for a wound. The effectiveness of cloth ash and turmeric in the treatment of wounds was assessed on morphological alterations, swelling, wound contraction rate, and duration of healing process. All of the surgical wounds were identical at the start of the trial and after 21 days. There were no unhealed wounds to be found.

The actions of turmeric on transforming growth factor-beta (TGF-p) are hypothesized to promote wound remodeling [18]. By specifically blocking the arachidonic acid cascade through both the lipoxygenase and cyclooxygenase (COX) pathways, turmeric (curcumin) reduces pain and inflammation and promotes homeostasis [19]. Rheumatoid arthritis, osteoarthritis, and post-operative inflammation can all be treated with turmeric (curcumin), which works similarly to NSAIDS in reducing inflammation [20].

The ash has been used since the time of the Prophet (S.A.W.S) is [21]. In the presence of trace components in the ashes, the crust created by the ashes supports and facilitates a suitable interior environment to heal the wound naturally. Ash contains a particularly high concentration of zinc, and when combined in the proper way, it may improve several processes, including enzyme activity, DNA synthesis, cell division, protein synthesis (important for tissue regeneration), and skin restoration.

The results of the study revealed that the sutured area's breadth was considerably diminished starting on day 7, regardless of treatments. Over the period of 5 to 15 days following injury, cutting edges move inward to help with wound closure. Insignificant differences in the weekly fall in contraction length across all groups' wounds were found. To create collagen fiber meshwork, the spontaneous wound healing process took place through a contractile mechanical area. Wound contraction is a dominant process during the natural healing of wounds, and wound regeneration and contraction have a combative relationship to one another [22].

Skin wound healing is a normal healing reaction to tissue damage. The interaction of several cells, including fibroblasts and myofibroblasts, is necessary for wound healing [12]. The complex process of wound healing, also known as cicatrization, is how the skin recovers from damage [23]. In comparison to the control group, the treatment groups' application of turmeric paste and ash caused the suture line to be less elevated and the wound area to swell. Wound healing in our study was completed on the eighteenth day with the ash-treated group, whereas in the turmeric-treated group, it was twenty-one days. Similarly, Shaikh and Shaikh (2009) [13] found that ashes influence wound healing, and it took 11 to 13 days for complete healing of the wound in rabbits.

The histopathology results demonstrated that the wounds had a definite tissue reaction. The histopathological investigation identified the infiltration of various inflammatory cells, the presence of hemorrhages, and the proliferation and regeneration of epithelium. The study's morphological results revealed no discernible differences between wounds treated with ash ointment and turmeric paste, but the histo-pathological analysis revealed some differences in how the two agents affected wound healing. Inflammatory cells were found to have infiltrated all groups on Days 1, 4, and 8 according to a histopathological analysis. On days 4 and 8, tissues of the turmeric-treated group displayed nearly healthy collagen fibers. On the other hand, the ash-treated group experienced degeneration and fiber loss at days 4 and 8. The variation in histopathological features was the deposition of carbon particles underneath the muscularis layer in the ash-treated group. More macrophage infiltration suggested an inflammatory phase and early wound healing activities [24, 24]. Curcumin accelerated the development of granulation tissue, collagen synthesis, tissue remodeling, and wound contraction [26].

Conclusions

It is concluded that cotton cloth ash, in addition to other herbal remedies, is a special treatment for goats' skin wounds. According to the gross appearance and morphological characteristics of the wound, both turmeric paste and ash ointment are equally effective

and contribute to the speedy recovery of incised wounds in Black Bengal goats. However, histopathological investigations show that turmeric paste, as opposed to ash, is more effective at healing incised wounds, and that using turmeric paste has sped up the healing process. By informing farmers about these findings, it would be able to improve the well-being of the cattle and prevent the skin degradation caused by wound complications. Furthermore, medical practitioners should also be aware of the benefits of turmeric and ash and consider using them as a feasible alternative for wound treatment.

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