



Efficacy Evaluation of a Novel Topical Herbal Spray Foam in the Management of Pocketed Wounds in Livestock

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Income from livestock plays an important role in the socio-economic lives of the people globally. Wounds are a common problem that reduces productivity, increase mortality, impair host immune system, and depreciate hide quality that result in severe economic losses to livestock owners. Various studies have been conducted to develop effective herbal preparations for wound management. A clinical trial was undertaken to evaluate the efficacy of a novel topical herbal spray foam *viz.* AV/MSF/19 (M/s Ayurved Limited, India) in the management of pocketed wounds in livestock. Twenty cattle having different types of pocketed wounds were assigned to one of two groups: Group T1, receiving treatment with AV/MSF/19, or Group T2, treated with a popular wound-healing spray (Brand X). The response to treatment was assessed based on clinical improvement and time required for wound healing. Results show that the mean time to 100% healing was 8 and 13.75 days in groups T1 and T2, respectively. In group T1, wound healed completely in lesser time and efficacy index was also higher than group T2. Based on the findings of the study, AV/MSF/19 was found to be efficacious in the management of wound in cattle.

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1. INTRODUCTION

The wound is defined as a break in the continuity of biological tissue, including skin, mucous membranes, and organ tissues [1]. In animals, wounds are commonly encountered as a result of inadequate management practices, diseases like Foot and Mouth Disease, Lumpy Skin Disease, ectoparasitic infestation, skin infections, etc.,. Wounds are responsible for major economic losses through poor hide quality, reduced weight gain, loss of fertility, and reduction in milk production [2]. Mortality may also occur from infected wounds as well as from severe loss of blood and tissue fluids [3]. Therefore, an early restoration of wounds is considered to be vital in improving and increasing productivity. Healing of wounds can be achieved earlier by following complete asepsis, removal of devitalized tissue, and regular dressing. In addition to these measures, various herbs and their extracts having antiseptic, anti-inflammatory, antimicrobial, and bio-stimulator activities can enhance the rate of healing [4]. Several oils of plant origin such as *Azadirachta indica*, *Pongamia pinnata*, and *Cinnamon verum* have been investigated for wound healing effect [5-7]. Many commercial preparations based on herbal constituents have also been shown to be very effective in wound healing [8,9]. This study was undertaken as a trial to evaluate the efficacy of novel topical herbal spray foam in the management of pocketed wounds in cattle.

2. MATERIALS AND METHODS

The trial was held from January to April, 2022 in the Indian state of Uttar Pradesh at Gangateeri Cattle Farm, Shahanshahpur, Varanasi (Longitude: 82.85°E and latitude: 25.1845°N). 20 cattle of either sex, suffering from different types of pocketed wounds of varying severity, were randomly assigned to one of two treatment groups of 10 animals each. Group T1 received treatment with the novel herbal spray foam, AV/MSF/19 (CharmHeal™; M/s Ayurved Ltd., India), and Group T2 with a popular herbal spray, Brand X. In each case, the wound was cleaned with potassium permanganate solution, wiped with dry sterile gauze, and treated twice daily with the respective treatment till recovery. In severely infected wounds, enrofloxacin at 7.5 mg and meloxicam at 0.5 mg per kg body weight of animal were additionally administered. Before

initiation of treatment, the wounds were graded by the attending clinician on an ordinal scale of 1-5, 1 being least severe and 5 being most severe, as per the severity at the first clinical presentation of the case. For comparing the efficacies of the treatments, an efficacy index, based on the total number and the severity of the cases treated successfully and the time to 100% healing of the wounds, was calculated using the modified formula of Tewari et al. [10]:

$$I = \frac{1}{3} \left\{ \frac{(HT_{\max} - HT)}{HT_{\max}} + (N/T) + \frac{\sum(S_i \times n)}{(S \times T)} \right\}$$

where I = efficacy index, S_i = severity of case, n = total number of cases of severity S_i treated successfully, S = highest possible severity of a case, T = total number of cases assigned to a treatment, N = total number of cases treated successfully with a treatment, HT_{\max} = maximum time in days to 100% healing, and HT = Mean time in days to 100% healing.

3. RESULTS

Wound produces negative influence on livestock production system and causes irreparable economic losses to livestock industry in terms of poor hide quality and mortality [11]. Effective and easy-to-administer point-of-care topical formulations are much needed in veterinary practice [10]. In the present study, novel topical herbal spray foam was evaluated for its efficacy in the management of pocketed wounds in livestock. The group-wise severity of cases at their first presentation, the respective responses to the treatments, mean days to 100% healing, and calculated efficacy indices are summarized in Table 1.

Comparing responses to treatments in evaluations like this is very problematic since any two different groups will rarely receive the exact same number of animals of the exact same severity. Therefore, an efficacy index was used to overcome the problem. In the calculation of the efficacy index, one-third of the weightage was given to the proportion of total cases treated successfully, one-third to the weighted mean of the severity of the successfully-treated cases, and remaining one-third to the time taken for 100% healing of the wounds. In both groups, wounds of all animal healed completely after treatment.

Table 1. Summary of severity of cases, treatment responses, mean days to 100% healing, and efficacy indices of the treatments

Groups	Severity	1	2	3	4	5	Total	Mean days to 100% healing (HT)	Efficacy index (I)
AV/MSF/19	Cases observed	0	3	3	3	1	10	8.00	0.68
	Cases cured	0	3	3	3	1	10		
Brand X	Cases observed	0	4	3	3	0	10	13.75	0.53
	Cases cured	0	3	2	3	0	8*		

*02 animals died during the course of treatment; cause of death was not attributable to the wounds or the treatment

In group T1, one animal had maximum severity score *i.e.* 5 whereas no animal in group T2 had severity score of 5. Still, the average number of days required to heal wound completely was 41.81% lesser in group T1. Although wounds of all the animals healed completely after treatment in both the groups, the wounds of the animals treated with AV/MSF/19 healed in shorter duration of time and, hence, efficacy index was higher in group T1 as compared to group T2.

4. DISCUSSION

Based on the calculated efficacy indices, AV/MSF/19 was found to be more effective for the management of pocketed wound in cattle than the popular competitor Brand X. AV/MSF/19 contains several active ingredients including oils of different parts of *Cedrus deodara*, *Milletia pinnata*, etc. which may account for its superior efficacy over competitor brands. *M. pinnata* seed oil contains two bioactive compounds karanjin and pongamol [12], which exert anti-inflammatory, antimicrobial, and antioxidant activities [13,14]. Previous study with extract of *M. pinnata* has reported increased wound contraction and tensile strength [5]. Oil of *C. deodara* has shown immunomodulatory activity [15]. Foam drug delivery is more effective than any other topical dosage form due to good spreadability and ease of application [16]. Likewise, AV/MSF/19 foam quickly occupies the void within the wound cavity and slowly coalesces and collapses, allowing uniform application on all wound surfaces. It also transiently cuts off access to atmospheric oxygen, thereby producing topical hypoxia at the surface of open wounds, which promotes angiogenesis and accelerates healing [17]. Hypoxia stimulates the growth and remodeling of the vasculature through activation of several HIF (hypoxia-inducible factor) target genes, including vascular endothelial growth factor and angiopoietin 2 [18]. In maggoty wounds, the topical hypoxia forces maggots to crawl to the surface of wounds for breathing, thereby facilitating easy removal [19]. The synergistic

action of essential oils and a foam formulation accelerates the wound healing process and makes the formulation more effective in wound treatment.

5. CONCLUSION

In conclusion, the topical herbal spray foam, AV/MSF/19 (CharmHeal™; M/s Ayurved Limited, India), was found efficacious for the management of cases of pocketed wound. The superior efficacy of AV/MSF/19 may be attributed to various constituents like oils of *Cedrus deodara* and *Milletia pinnata* in a foam presentation that accentuated the vulnerary activity through manifold mechanisms.

COMPETING INTERESTS

AV/MSF/19 (CharmHeal™) is manufactured commercially by M/s Ayurved Limited, India. The authors, BN and BG, are employees of M/s Ayurved Limited, India.

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