Effects of *Diallium* and *Ziziphus honey* in second-degree burns on wistar rats

Abstract:

Background: Nowadays, the use of honeys in the treatment of burns and wounds has aroused growing interest due to its anti-inflammatory, antioxidant and healing properties.

Aim: The aim of this study was to evaluate the effects of *Diallium* and *Ziziphus honey* in second degree burns on wistar rats.

Methodology: A metal cylinder with a diameter of 3 cm was heated for five minutes. In order to cause experimental burns, the rats' shaved skin was lightly pressed with the cylinder for twenty seconds so as to induce second-degree burns.

Results: The daily application of honey induces a healing dependent on typology and concentration. The healing rate is higher with DZ, with a score of 1.00 ± 0.63 vs 1.25 ± 0.43 for JUJ which induces almost complete tissue repair after 21 days of treatment.

Conclusion: Findings from the research confirm the use of traditional honeys for burns and wound healing.

Keywords: Honeys, burns, wounds, cicatrization

Abréviations: DZ : *Diallium* Ziguinchor et JUJ : Jujubier Podor

1. INTRODUCTION

The wide use of honey to treat different infections among Muslims and in many Islamic countries is based on the belief in the words regarding honey as stated in the Holly Quran about 1900 years ago “and your lord inspired the bee, saying: “Take your habitations in the mountains and in the trees and in what they erect, then, eat of all fruits, and follow the ways of your Lord made easy (for you).” There comes forth from their bellies, a drink of varying colour wherein is healing for men. Verily, in this is indeed a sign for people who think [1, 2]. However, honey treatment meets certain clinical conditions, which are : the viscosity of the honey, which acts as a barrier against bacteria, preventing them from colonizing the wound surface [3]. Using honey to treat severe acute post-operative wound infection: After hysterectomies and cesarean sections, topical application of undiluted, crude honey has been used to treat severe acute post-operative wound infection brought on by Gram positive and Gram negative bacteria. This stops bacterial infections, shortens the time patients need to use antibiotics and stay in the hospital, speeds up wound healing, stops dehiscence, helps with restructure, and leaves less scars behind [4]. Honey has traditionally been used as wound healer for skin condition wounds. It has been demonstrated to speed up the healing process, for instance, in mild to moderate superficial and partial thickness burns, while there is currently insufficient evidence to support its effectiveness in treating other illnesses [5, 6]. Honey is a complex mixture of 82.0% carbohydrates (sucrose, fructose, maltose), 0.3% protein, 17.0% water and 0.7% minerals, vitamins and antioxidants [7] In addition to sugars, honey has a high

mineral content and a number of vitamins, particularly the B complex and vitamin C. Ascorbic acid, pantothenic acid, niacin, and riboflavin are among the vitamins in honey, along with minerals like calcium, copper, iron, magnesium, manganese, phosphorus, potassium, and zinc [8].

In the course of our bibliographical research, no data has been discovered on the study of the healing of honey in Senegal. However, studies on healing by the use of plant extracts were conducted there by [9, 10]. Based on the above, we have been interested in looking for healing potential of honey in an experimental model of second-degree burns in Wistar rats.

2. MATERIALS AND METHODS

2.1 Sampling

Beekeepers with modern production units supplied honey samples in hermetically sealed jars. The samples were transported at the Laboratory of Pharmacognosy and Botany at the Faculty of Medecine, of Pharmacy and of Odontology of the Cheikh Anta DIOP University (CADU) of Dakar, and then kept refrigerated until analysis began.

2.2 Animals

The rats ranged in weight from 148 to 226 g. The animals were kept in a cage with a temperature of 25 ± 2°C, a 12-hour light cycle, and unlimited access to food and water. The experimental procedures were carried out in compliance with the institutional ethics committee's (CADU Research Ethics Committee) norms.

2.3 Methodology

An experimental rat burn model was used to measure healing activities [11]. Twenty rats were split up into the following four batches of five : Rats in Batch 1 are untreated. Rats in Batch 2 were given the healing medicine sulfadiazine ; in Batch 3, the rats were given *Diallium Z honey* (DZ); in Batch 4, the rats were given *Ziziphus honey* (JUJ). The rats were subsequently given an intraperitoneal injection (1 mL/100 g) of 3% chloral solution to induce anesthesia. The dorsal flanks of the rats were washed and shaved. A metal cylinder with a diameter of 3 cm was heated for 5 minutes to cause experimental burns. In order to cause second-degree burns, the cylinder was applied for 20 seconds by lightly pushing on the rats' shaved skin [12].

A system of assigning scores based on the severity of the burn was used to measure healing activities (Table 1) [13]. For 28 days, scores were evaluated every four days for twenty eight days.

2.4 Statistical analysis

Data were expressed as mean ± standard error of the mean (SEM). The GraphPad 10.0 software was used for analyses. A one-way analysis of variance (ANOVA) followed by Dunnett's post hoc test against the control group. P-values <0.05 Table 1: Experimental burns' evolution scores.

Table 1: Experimental burns' evolution scores.

Score	Cicatrization process evaluation
0	Healing is complete and tissue repair is complete
1	Tissue healing is almost complete
2	Remnants of the crust remain the size of the lesion decreases (skin reconstruction)
3	All dead tissues (scabs) are removed, wounds and oozing
4	Necrotic skin is partially removed, ulcerated and oozing
5	Necrotic skin completely covers the burned area

3. RESULTS AND DISCUSSION

3.1 RESULTS

3.1.1. Evolution of second-degree experimental burn scores in rats without treatment and sulfadiazine application

The burned area was remained covered in necrotic skin eight days after the experimental burn was induced, corresponding to score 5. After three weeks, the burned skin showed ulceration in the absence of treatment (score 4). The experimental burn has an open, oozing wound (score 2) after 4 weeks, which indicating to a total absence of healing.

When sulfadiazine is applied on a daily basis, wound healing is much better than in the control group (Fig.1). Fig.2 shows photographs of burned surfaces

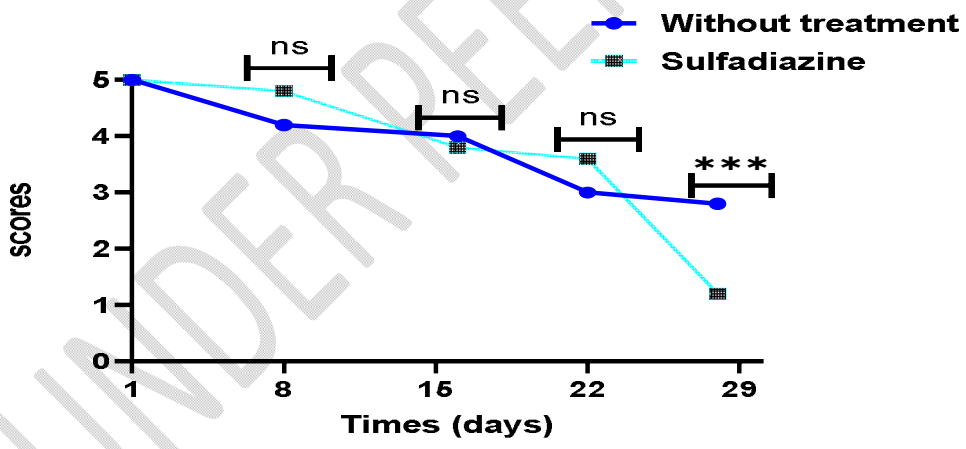

Fig.1. Evolution of second-degree experimental burn scores in rats without treatment and sulfadiazine application.

ns : no significant ; *=p<0.05 ; **=p<0.01; ***=p<0.001; ****=p<0.0001

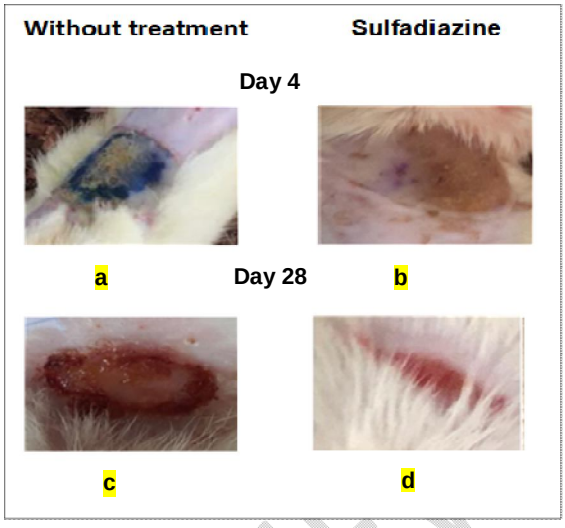

Fig. 2. Photographs of burned surfaces without treatment and with sulfadiazine.

3.1.2. Evolution of second-degree experimental burn scores after treatment with the *Diallium* and *Ziziphus honeys*.

After 20 days, daily application of honey samples showed nearly total tissue healing. The scores obtained are 1.2. Hair regrowth indicates that the healing process is complete after 28 days of treatment, especially when *diallium* and *ziziphus honeys* are used. Figure 3 shows the score evolution curves for each group, supported by illustrative images of the rats' healing process.

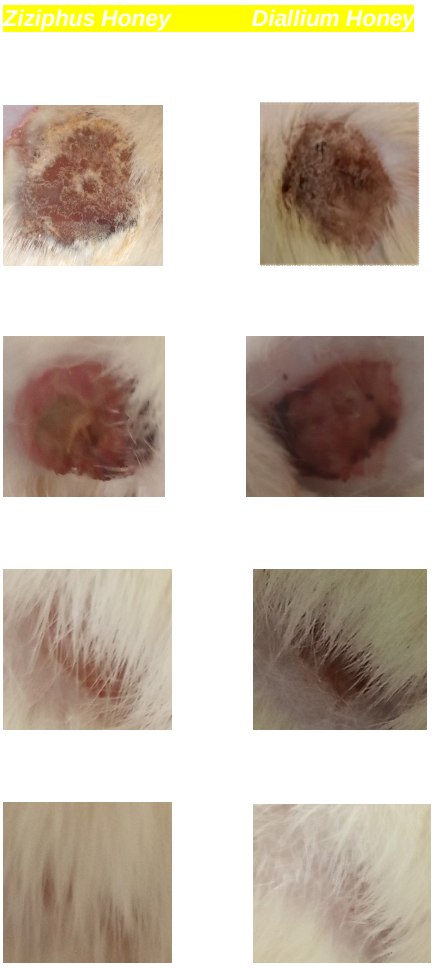

Fig. 3. Healing effect of *Diallium* and *Ziziphus honeys* experimental second-degree burns (Photographs)

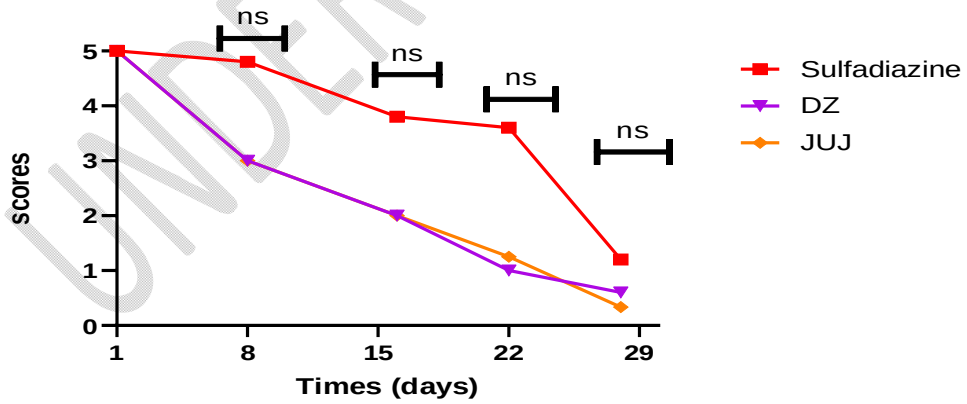

Fig 4 : Score evolution curves for Sulfadiazine, *Diallium honey* and *Ziziphus honey*

ns : no significant

3.2 DISCUSSION

The objective of this study was to show how honeys can heal second-degree burns in Wistar rats, a model of experimental burns.

After four weeks of daily application to the burn, sulfadiazine was not linked to full recovery. Clinical trials for first-degree burns are where sulfadiazine is most frequently utilized as a reference product [14]. The fact that this study's experimental burn didn't heal after four weeks of sulfadiazine treatment indicates that it was at least a profound second-degree burn. Our findings in a second-degree burn model are consistent with a number of earlier research using honeys, and the healing rate is nearly full after three weeks [15, 16].

In the wistar rat model of experimental second-degree burns, honeys produce concentration-dependent wound healing. Indeed, healing is faster with *DZ* than *JUJ honey*.

Many studies have confirmed the beneficial effects of honey on ulcerous wounds [17, 18, 19 and 20]. The outcomes showed faster overall healing rates, shorter average healing periods, and better elimination of wound infection. Honey therapy has been demonstrated to be a cost-effective treatment [17].

In research by [21], there was a reduction in both wound pain and odor ; however, there was no statistically significant difference in healing time.

Honey has been shown to have some healing properties for wounds. It is a curative treatment that is applied locally in a variety of therapeutic methods. According to Postmes TJ *et al.*, the primary factors that facilitate burn healing are the high tonicity and acidic pH of honey [22]. Our research indicates that application honey to rats can help them recover their wounds. Honey's glycolytic enzyme activity provides enough energy for cell repair, which speeds up the healing process from wounds. Three essential stages of wound healing are collagen synthesis, wound contraction, and epithelialization. Thus, intervention during any of these phases can either increase or decrease the healing process' collagen production phase [23].

According to Sène M *et al.,* plants' flavonoids and tannins are involved in perfect healing [24]. Plants have antibacterial, antioxidant, and anti-inflammatory qualities in addition to the processes involved in wound healing [25, 26]. Several varieties of honey have also been shown to possess these qualities [27, 28, 29 and 30]. Both manuka honey have demonstrated *in vivo* activity and can be used to treat burns, infected wounds, and ulcers [31].

We saw that there was no smell and that there was sensation that caused the wounds to be scratched throughout our manipulations. Other authors have noted similar results when employing honeys in surgical wound treatments [32].

4. CONCLUSION

The purpose of this study was to assess the ability of Senegalese honeys to cure second-degree burns in an experimental model of Wistar rats. After 22 days, DZ honey had almost fully repaired the tissue. This therapeutic action might be related to the methylglyoxal and hydrogen peroxide present. The outcomes demonstrate the honeys therapeutic potential for treating second-degree burns, which would support their application in conventional burn and wound care settings. Future research ought to concentrate on how honey aids in the healing of surgical incisions.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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