Cicatrizing effect of *Opuntia ficus-indica* aqueous extract and seeds powder in New Zealand rabbits

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Abstract: The present study aimed to evaluate the healing effect of *Opuntia ficus-indica* (L.) following experimental burns in the rabbit model. To do this, we have prepared two products from our plant material: a homogeneous aqueous extract from cladodes and a fine powder from the seeds of this plant. In a second step, we have shaved six New Zealand rabbits over the entire dorsal surface. Twenty-four hours later, four burns were made on the back of each rabbit, the treatments were performed in the following manner: Burn A was not treated (control), burning B was treated with aqueous extract, burning C was treated with Cicatrol® (as a healing reference drug), burning D was treated with a mixture of aqueous extract and seeds powder (v/v). The evolution of the healing process was investigated daily. The results have shown a significant reduction of healing times in the three treatment groups. No significant difference was observed between the aqueous extract and the reference drug. However, there was a significant difference between the mixture and all the other groups. Our study concludes that *Opuntia ficus-indica* L. may stimulate the cicatrizing process of experimental burns in the rabbits.

Keywords: Burns; wound healing; *Opuntia ficus-indica* L.; rabbits.

Introduction

The wound healing process involves integrated events including inflammation, granulation tissue formation, matrix deposition and remodeling (Varedi and Englander 2006). The objective in wound management is to heal the wound in the shortest time possible, with minimal pain, discomfort, and scarring to the patient (Mackay and Miller 2003).

The prickly pear is a fruit exotic strange and fascinating, belonging to family Cactaceae. This family is reported to contain about 130 genera and nearly 1500 species (Kaur et al. 2012). The prickly knows the passion of rich global consumer who appreciates not only for its flavor, but also particularly interesting for its nutritional qualities: low in calories, rich in water, sugars, minerals, vitamins A and C and fiber, as well as type pigments betalains and phenolic compounds (Maataoui and Hilalli 2004); these results were applied in the food industry and cosmetics (Arba 2009; Maataoui et al. 2006). Until the seventies, little interest has been given to this species. With the development of exotic fruit market in Europe and the United States, efforts have increased to domesticate and an industrial crop for the socio-economic and environmental of this culture (Kenny 1998; Maataoui et al. 2006). This plant has a high adaptation to the most hostile, its extension is limited mainly by low winter temperatures; the threshold is -10 °C (Kenny 1998). According to Ben Salem and Nefzaoui (2002), there was an increased importance of cactus as livestock feed in arid and semi-arid zones due to its drought resistance, high biomass yield, high palatability and tolerance to salinity. Galati et al. (2002) have collected from literature some therapeutic effects of this plant in folk medicine. Some parts of this plant are used in traditional medicine as: emollient, moisturizing, cicatrizant, hypocholesterolemic, hypoglycemic agent and in gastric mucosa diseases. It has been reported by Ribeiro et al. (2010) that the cladodes of this plant are used as vegetables; animal food; medicinal plant for diarrhea and hyperlipidemia, anti-inflammatory and cosmetics.
The present study aims to evaluate the effect of this plant on the healing process following experimental burns in the rabbit model.

**Materials and methods**

**Plant material**

*Opuncia ficus-indica* plant was collected in the Constantine region (Northeast Algeria), September 2010. The cuticle of cladodes was removed. Then, the cladodes were crushed and mixed with a grinder (Moulinex) until homogeneous juice. This aqueous extract was filtered before being applied to rabbits. Seeds of *Opuntia ficus-indica* were dried and ground into a fine powder with an electric grinder (Moulinex).

**Laboratory animals**

Male New Zealand rabbits (n=6, three months age, with an average weight of 2-2.5 kg) were purchased from a local farmer, Zighoud Youcef, Constantine. The rabbits were maintained in individual metal cages for 10 days for a period of adaptation before experimentation with an ambient temperature of 22 ± 2 °C and a relative humidity of 60% and a 12-hour light/dark. Distribution of water and food were provided *ad libitum*. All experimental procedures adopted were approved by the faculty of nature sciences and life, Mentouri Constantine University, Algeria.

**Experimental Protocol**

The study was performed according to the technique described by Hamdi Pacha et al. (2002). The rabbits were shaved over the entire dorsal surface by an electric clipper. Twenty four hours after, we carried out an IM injection of acepromazin at 0.3 ml per rabbit and then we anesthetized them with xylocaïn at 0.3 ml per rabbit S/C. Then four circular burns were made on the back of each rabbit, two dorsal (left and right) and 2 lumbar (left and right) with a circular metal disc (22 mm) that was preheated in boiling water for 3 minutes and immediately placed on the backs of rabbits for 15 seconds without exerting any force in order to obtain identical burns. The burns were treated once daily with 0.5g of each product. The treatments were performed in the following manner: Burn A was not treated (control), burning B was treated with aqueous extract of cladodes, burning C was treated with Cicatrol® (as a healing reference drug), burn D was treated with a mixture (aqueous extract + seeds powder) (Figure 1). The treatments were alternated in different rabbits so that each product was applied to the four anatomical burned regions of each rabbit. The study has adopted a clinical approach to investigate the evolution of healing process.

![Figure 1: Localization and treatment of burns.](image)

**Statistical analysis**

The results were expressed as mean with variance. The results were analyzed by ANOVA. The data were considered significant at p < 0.05.

**Results and Discussion**

The results about the evolution of healing process in term of inflammation, wounds retraction and the epithelization periods in the different treatment groups were mentioned in Figure 2 and Table 1. The untreated and the wounds treated with the aqueous extract have shown an equal inflammatory duration. However, in the mixture treatment the inflammatory phase was significantly shortened (p < 0.05) when compared to other treatment groups or untreated wounds. In Cicatrol® treatment group, the erythema was observed until the 10th day post burns.
Cicatrizing effect of *Opuntia ficus-indica* L.

**Table 1:** Healing time of burns (in days).

<table>
<thead>
<tr>
<th>Rabbits</th>
<th>Mixture (Aqueous extract+Seeds powder)</th>
<th>Aqueous extract</th>
<th>Cicatrol®</th>
<th>Untreated wounds (control)</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>20</td>
<td>29</td>
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<td>2</td>
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<td>6</td>
<td>19</td>
<td>21</td>
<td>23</td>
<td>28</td>
</tr>
</tbody>
</table>

Statistical data (ANOVA)

- Mixture Vs Control: S
- Aqueous extract Vs Control: S
- Cicatrol Vs Control: S
- Mixture Vs Cicatrol: S
- Aqueous extract Vs Cicatrol: NS
- Mixture Vs Aqueous extract: NS

δ²: variance; S: Significant (p < 0.05); NS: not significant (p > 0.05).

The healing times obtained in all the treated groups were significantly lower than untreated wounds. The mixture has registered a significant reduction of healing time when compared to reference drug or aqueous extract. The difference between these two later was not significant (p > 0.05).

The present results have confirmed that *O. ficus-indica* may stimulate the healing process of burns in the rabbit model. These results are in accordance with that obtained in a study of Galati et al. (2003). These authors have tested the healing activity of a base cream containing 15% lyophilized cladodes and of a commercial...
ointment on dermal wounds in rats. They have treated the animals for 3 and 5 days and have conducted a histological study. Their study was concluded that *O. ficus-indica* treatment accelerates wound healing, probably by involving the proliferation and migration of the keratinocytes in the healing process.

**Conclusion**

The present preliminary study has shown a positive effect of aqueous extract from cladodes and the mixture (aqueous extract + seeds powder) of *Opuntia ficus-indica* L. on the healing process following experimental burns in the rabbit model. Other studies are recommended to understand the mechanism of action and to determine the molecules implicated in the healing property of this plant.

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**References**


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