Evaluation of the Wound Healing Activity of Sesame Oil Extract in Rats

Mohammad Reza Sharif, Javad Alizargar and Alireza Sharif

Department of Pediatrics, Kashan University of Medical Sciences, Kashan, Iran
Student Research Committee, Kashan University of Medical Sciences, Kashan, I.R. Iran
Department of Infectious Disease, Kashan University of Medical Sciences, Kashan, Iran

Abstract: Wound healing is a very complex process. Free radicals are generated at the site of injury, which are known to impair the healing process. The use of antioxidants has been shown to promote wound healing. Sesamin and sesamolin are the oil-soluble lignans in the sesame oil extract and proved to have antioxidant activity. In the present study, we have examined the characteristics of sesame oil extract in healing dermal wounds in rats. Male Wistar rats divided in 5 groups of 10 animals each and anesthesia was administered by an intramuscular injection of xylazine and ketamine. The right side skin of the rats was shaved and an incision of 4cm on the shaved skin was made. Group I-IV was treated with 0.2 sesame oil extract, 0.13 sesame oil extract, 0.1 sesame oil extract and standard treatment (Gentamycin ointment (1 %)). Group V was treated with olive oil. The rats were treated with the extract and ointment once a daily until epithelialization and complete wound closure was recorded. A better healing pattern was observed in rats treated with 0.2 sesame oil extract, 0.13 sesame oil extract and 0.1 sesame oil extract compared with the control group (olive oil). There was a significant reduction in wound length and the closure rate was much faster in sesamin extract groups when compared with control groups. The epithelialization period of the groups I-IV was much shorter than the group V (control). From the results obtained, it may be concluded that Sesame oil extract has the potential to be developed into new therapeutic agent for wound healing.

Key words: Wounds And Injuries, Wound Healing, Sesame Oil, Plants, Medicinal

INTRODUCTION

Wounds are among the major and widely occurring pathologies [1]. The process of wound healing is essential to prevent the invasion of damaged tissue by pathogens and to partially or completely reform the damaged tissue [2]. The healing involves different phases, including inflammation, granulation, fibrogenesis, neo-vascularization, wound contraction and epithelialization [3]. Several natural and plant products which are composed of active principles like flavinoids, triterpens, alkaloids and other biomolecules influence one or more phases of the healing process [2]. The wound healing properties of Aloe vera [4], Centella asiatica [5], Tridax procumbens [6], curcumin [7], Jatropha curcas [8], Rubia cordifolia[9], Bialm [1], buckthorn [2], Croton bonplandianum [10], green tea [11], Phyllanthus niruri [12] and Sphaeranthus indicus Linn [13] have been reported and experimentally studied on various animal models. In this study, we investigated the extract of sesame oil for pro-wound healing activity on incision wound model.

Medicinal plants have been used for many years for different treatments in Iran [14]. Sesame (Sesamum indicum L.) is one of these medications. It is one of the major oil crops in the world and is an important crop for international trading. It is produced at 2.6 million tons per year, 70% of which come from India, China, Myanmar and Sudan. Breeding programs for sesame have been focused mostly on the crop’s productive capacity and high oil content [15-17]. It is an important oil in some regions [18-20]. Recently, however, the functional activity of lignans present in sesame seeds has become of major interest. Oil-soluble ligan compounds include sesamin...
and sesamolin. These lignans exist in relatively high contents as compared with other lignan compounds. Previously, sesamin and sesamolin were identified [21]. In 1950, sesamolin was found and reported to be a precursor of sesamol, an antioxidant substance in sesame oil [22]. Succeeding researches reported the various functions of sesamin and sesamolin such as being an antioxidant [23], anticancer [24] and in the metabolic control of lipid [25], cholesterol [26] and alcohol [27]. Only recently was sesame considered as a functional food for human health control.

Sesame seeds and sesame oil have long been used as health foods in Asia to increase energy and to prevent aging. The nonfat portion (1-2%) of this oil contains sesamin, sesamol, sesamolin, sesaminol and episesamin [28]. Sesamin, the major lignan found in sesame oil has been demonstrated to enhance hepatic detoxification, to protect against oxidative stress and to prevent the development of hypertension [29]. Sesame oil has antimicrobial activities that have been reported before [30].

The use of sesame oil extract in skin infections and wound treatment in our local community in middle of Iran has inspired this present study in which we have investigated sesame oil extract for pro-wound healing activity.

MATERIALS AND METHODS

Freshly-harvested and air-dried seeds (Karaj (K-29) cultivar) were used in the extraction procedure. K-29 has 52% of oil in the extract [31].

Sesame oil of 200 mL was dissolved in 1500 mL acetone and stored at-70°C for 24 h. The solidified triacylglycerol was discarded and the acetone extract was collected after filtration. After acetone evaporation, the oil was saponified with 25 mL ethanol containing 5% potassium hydroxide for 1 h. The unsaponifiables were added with 10 mL diethyl ether and air-dried at room temperature overnight. Crude extract of approximately 2 g was obtained as white crystalline powder containing 90% sesamin and 10% sesamolin. We mixed this 2 g with 10, 15 and 20 mL of olive oil to make a 0.2, 0.13 and 0.1 gr/ml sesame oil extract.

Male Wistar rats weighing about 150–170 g were used in the present study. They were individually housed and maintained in a laboratory environment in a 12 hour dark–light cycle. All animals were fed with standard pellet diet and water ad libitum. The experiments were performed in accordance with the regulations specified by the Institute’s Animal Ethical Committee and conform to national guidelines on the care and use of laboratory animals.

Rats were divided in 5 groups of 10 animals each and anesthesia was administered by an intramuscular injection of xylazine 10mgkg-1 and ketamine 75mgkg-1. The right side skin of the rats was shaved and the underlying skin cleaned with 70% ethanol. An incision of 4cm on the shaved skin was made and sutured. Sutures were made with Nylon 0 thread with cutting needle. Sutures were simple and were made at the ends and in the middle of the wound.

Group I-IV was treated with 0.2 sesame oil extract, 0.13 sesame oil extract, 0.1 sesame oil extract and standard treatment (Gentamycin ointment (1 %)) respectively. Group V was treated with olive oil as the control group. All of the extracts and the ointment and olive oil were used topically so the whole wounds were soaked and covered with the substance. The rats were treated with the substances once a daily until epithelialization and complete wound closure was recorded. Wounds were left undressed to the open environment and the animals were kept individually in separate cages. The progressive changes in wound length were measured in centimeter at every 3 days interval until epithelialization and complete wound closure was recorded. Wound contraction was calculated as a percentage of the original wound size. Progressive decrease in the wound size was monitored periodically. The relative wound area results were compared using one-way analysis of variance (ANOVA) followed by Dunnett’s tests. P values less than 0.05 were considered as indicative of significance.

RESULTS

A better healing pattern was observed in rats treated with 0.2 sesame oil extract, 0.13 sesame oil extract and 0.1 sesame oil extract compared with the control group (Table 1). There was a significant reduction in wound length and the closure rate was much faster in sesamin extract groups when compared with control groups. The epithelialization period of the groups I-IV was much shorter than the group V (control). The table 1 and fig. 1 showed the effect of 0.2, 0.13 and 0.1 sesame oil extract on incision wound model in rats.
Table 1: The effect of sesame oil extract on incision wound healing in rats.

<table>
<thead>
<tr>
<th>Treatment group</th>
<th>DAY3</th>
<th>DAY6</th>
<th>DAY9</th>
<th>DAY12</th>
<th>DAY15</th>
<th>DAY18</th>
<th>DAY21</th>
<th>Epithelialization</th>
<th>Epithelialization</th>
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<td></td>
<td>(cm)</td>
<td>(cm)</td>
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<td>(cm)</td>
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<td>(cm)</td>
<td>period (Days)</td>
<td>period (Days)</td>
</tr>
<tr>
<td>0.2 sesame oil</td>
<td>3.17±0.197</td>
<td>2.38±0.226</td>
<td>1.39±0.252</td>
<td>0.71±0.284</td>
<td>0.33±0.216</td>
<td>0.14±0.14</td>
<td>0.09±0.09</td>
<td>16.5±0.921</td>
<td>16.5±0.921</td>
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<td></td>
<td>20.7%</td>
<td>40.5%</td>
<td>65.2%</td>
<td>82.2%</td>
<td>91.7%</td>
<td>96.5%</td>
<td>97.7%</td>
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<tr>
<td>0.13 sesame oil</td>
<td>3.24±0.155</td>
<td>2.57±0.223</td>
<td>1.70±0.299</td>
<td>1.08±0.330</td>
<td>0.68±0.263</td>
<td>0.40±0.15</td>
<td>0.25±0.119</td>
<td>19.2±1.743</td>
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<td></td>
<td>19%</td>
<td>35.7%</td>
<td>57.5%</td>
<td>73%</td>
<td>83%</td>
<td>90%</td>
<td>93.7%</td>
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<tr>
<td>0.1 sesame oil</td>
<td>3.34±0.119</td>
<td>2.88±0.131</td>
<td>1.73±0.292</td>
<td>1.09±0.235</td>
<td>0.52±0.190</td>
<td>0.25±0.12</td>
<td>0.11±0.082</td>
<td>19.8±1.113</td>
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<td>16.5%</td>
<td>28%</td>
<td>56.7%</td>
<td>73.7%</td>
<td>87%</td>
<td>93.7%</td>
<td>97.2%</td>
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<td>Standard treatment</td>
<td>3.04±0.157</td>
<td>2.35±0.197</td>
<td>1.25±0.276</td>
<td>0.43±0.178</td>
<td>0.12±0.099</td>
<td>0.06±0.06</td>
<td>0.01±0.010</td>
<td>15.3±1.135</td>
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<tr>
<td></td>
<td>24%</td>
<td>41.2%</td>
<td>69.2%</td>
<td>89.2%</td>
<td>97%</td>
<td>98.5%</td>
<td>99.7%</td>
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<tr>
<td>Olive oil</td>
<td>3.4±0.091</td>
<td>3.04±0.135</td>
<td>2.50±0.145</td>
<td>1.91±0.182</td>
<td>1.63±0.188</td>
<td>1.06±0.168</td>
<td>0.65±0.109</td>
<td>26.4±1.077</td>
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<td></td>
<td>15%</td>
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<td>37.5%</td>
<td>52.2%</td>
<td>59.2%</td>
<td>73.5%</td>
<td>83.7%</td>
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(Values expressed as Mean ± SEM), * p< 0.05, ** p< 0.01, *** p= 0.001.

DISCUSSION

Wounds are referred to as disruption of normal anatomic structure and function. Skin wounds could happen through several causes like physical injuries resulting in opening and breaking of the skin [32]. Wound healing is a very complex, multifactor sequence of events involving several cellular and biochemical processes. The aim in these processes is to regenerate and reconstruct the disrupted anatomical continuity and functional status of the skin [9]. Healing process, a natural body reaction to injury, initiates immediately after wounding and occurs in four stages. The first phase is coagulation which controls excessive blood loss from the damaged vessels. The next stage of the healing process is inflammation and debridement of wound followed by re-epithelialization which includes proliferation, migration and differentiation of squamous epithelial cells of the epidermis. In the final stage of the healing process collagen deposition and remodeling occurs within the dermis [33].

In the present study, we have examined the characteristics of sesame oil extract in healing dermal wounds in rats and observing if there is a dosage-response relation. The results of present study indicated that sesame oil extract promotes significant wound healing activity. This was demonstrated by a significant increase observed in the rate of wound contraction in the case groups compared with olive oil and standard treatment group. And also a dosage-response relation was observed (Fig.1).
Free radicals are generated at the site of injury, which are known to impair the healing process by causing damage to cellular membranes, nucleotides, proteins and lipids. In this context, several antioxidants like curcumin, vitamin E etc., have been reported to give protection against oxidative damage to tissues [34, 35]. The use of antioxidants has been shown to promote wound healing [36, 37]. Many plant extracts and medicinal herbs have been shown to possess potent antioxidant activity. As we mentioned, sesame oil extract has a potential antioxidant activity which helps to prevent oxidative damage and promote the healing process.

**CONCLUSION**

Summing up, sesame oil extract has a beneficial role in wound healing. Its wound healing properties may be due to free radical scavenging capacity and antioxidant Activity it may have. Further investigations may be clear out the exact mechanisms of this herbal extract in wound healing. Investigations on excisional wound models and on other laboratory animals and even on human may help the concept to be confirmed so this extract, that long have been used in Iran in wound treatment may become a proved treatment for wounds.

**REFERENCES**


