World Journal of Medical Sciences 9 (2): 74-78, 2013
ISSN 1817-3055

DOI: 10.5829/idosi.wjms.2013.9.2.75195

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

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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 epithalialization 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* S*phaeranthus 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 lignan compounds include sesamin

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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 100 mL distilled water and extracted three times with 60 mL diethyl ether. After ether evaporation, 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 epithalialization 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.

	Wound length in cm an percentage of wound contraction							
Treatment group	DAY3	DAY6	DAY9	DAY12	DAY15	DAY18	DAY21	Epithelialization period (Days)
0.2 sesame oil extract	3.170±0.197 20.7%	2.3800±0.226 40.5%	1.3900*±0.252 65.2%	0.7100**±284 82.2%	0.3300***±216 91.7%	0.1400***±014 96.5%	0.09***±0.09 97.7%	16.5***±0.921
0.13 sesame oil extract	3.240±0.155 19%	2.5710±0.223 35.7%	1.7000±0.299 57.5%	1.0800±0.330 73%	0.6800**±0.263 83%	0.4000**±0.155 90%	0.25±0.119 93.7%	19.2**±1.743
0.1 sesame oil extract	3.340±0.119 16.5%	2.8800±0.131 28%	1.7300±0.292 56.7%	1.0900±0.235 72.7%	0.5200**±0.190 87%	0.2500***±0.152 93.7%	0.11***±0.082 97.2%	19.8**±1.113
Standard treatment	3.04±0.157 24%	2.3500±0.197 41.2%	1.2300**±0.276 69.2%	0.430***±0.178 89.2%	0.120***±0.099 97%	0.060***±0.060 98.5%	0.01***±0.010 99.7%	15.3***±1.135
Olive oil	3.4±0.091 15%	3.04±0.135 24%	2.500±0.145 37.5%	1.910±0.182 52.2%	1.630±0.188 59.2%	1.0600±0.168 73.5%	0.65±0.109 83.7%	26.4±1.077

(Values expressed as Mean ± SEM), * p< 0.05, ** p< 0.01, *** p< 0.001.

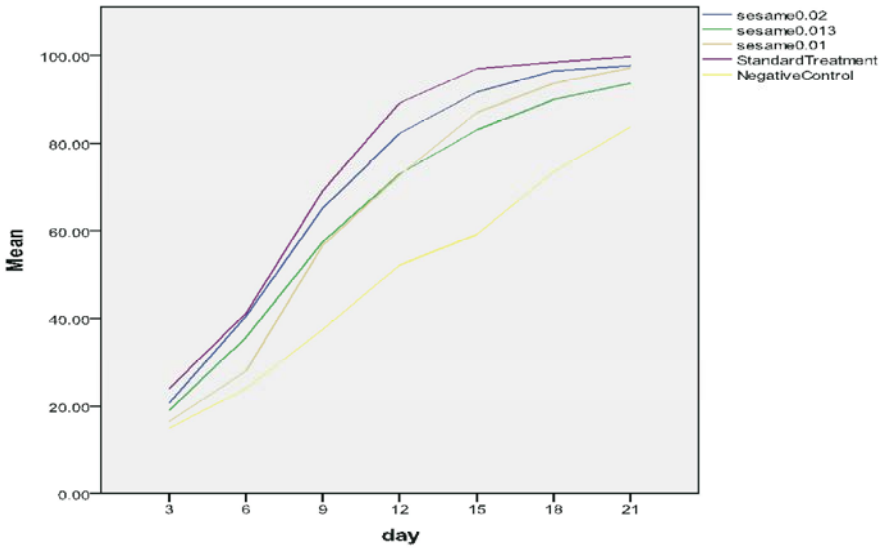

Fig. 1: The rate of mean wound contraction percentage compared in the five groups

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

1. Rakhimov, K.D., R.N. Pak, A.V. Tekhneryadnov, S.M. Adekenov, Z.K. Kul'zhanov, T.D. Kim and B.G. Koishibaev, 2000. wound healing activity of Bialm ointment. Pharmaceutical Chemistry Journal, 34: 55-56.
2. Gupta, A., R. Kumar, K. Pal, V. Singh, P.K. Banerjee1 and R.C. Sawhney, 2006. Influence of sea buckthorn (Hippophae rhamnoides L.) flavone on dermal wound healing in rats, Molecular and Cellular Biochemistry, 290: 193-198.
3. Clark, R.A.F., 1996. Wound repair: Overview and general considerations. In: R.A. Clark and P.M. Henson (eds). The Molecular and Cellular Biology of Wound Repair. Plenum Press, New York, pp: 3.
4. Chitra, P., G.B. Sajithlal and G. Chandrakasan, 1998. Influence of Aloe vera on the glycosamino-glycans in the matrix of healing dermal wounds in rats. J Ethnopharmacol, 59: 179-186.
5. Shukla, A., A.M. Rasik, G.K. Jain, R. Shanker, D.K. Kulshrestha and B.N. Dawan, 1999. In vito and in vivo wound healing activity of asiaticoside isolated from Centella asiatica. J Ethnopharmacol, 65: 1-11.
6. Udupa, A.L., D.R. Kulkurni and S.L. Udupa, 1995. Effect of Tridex procumbens extracts on wound healing. Int J Pharmcognosy, 33: 37-40.
7. Sidhu, G.S., A.K. Singh, D. Thaloor, K.K. Banaudha, G.K. Paitnaik, R.C. Srimal and R.K. Maheshwari, 1998. Enhancement of wound healing by curcumin in animals. Wound Rep Reg., 6: 167-177.
8. Esimone, C.O., C.S. Nworu and C.L. Jackson, 2009. Cutaneous wound healing activity of a herbal ointment containing the leaf extract of Jatropha curcas L. (Euphorbiaceae), International Journal of Applied Research in Natural Products, 14: 1-4.
9. Karodi, R., M. Jadhav, R. Rub and A. Bafna, 2009. Evaluation of the wound healing activity of a crude extract of Rubia cordifolia L. (Indian madder) in mice, International Journal of Applied Research in Natural Products, 2: 12-18.
10. Divya, S., K. Naveen Krishna, S. Ramachandran and M.D. Dhanaraju, 2011. Wound Healing and In Vitro Antioxidant Activities of Croton bonplandianum Leaf Extract in Rats. Global Journal of Pharmacology, 5: 159-163.
11. Karimi, M., P. Parsaei, S.Y. Asadi, S. Ezzati, R. Khadivi Boroujeni, A. Zamiri and M. Rafieian-Kopaei, 2013. Middle-East Journal of Scientific Research, 13: 14-19.
12. Abdul-Aziz Ahmed, K., M. Ameen Abdulla and F.M. Mahmoud, 2012. Wound Healing Potential of Phyllanthus niruri Leaf Extract in Experimental Rats. Middle-East Journal of Scientific Research, 11: 1614-1618.
13. Jha, R.K., N. Garud and R.K. Nema, 2009. Excision and Incision Wound Healing Activity of Flower Head Alcoholic Extract of Sphaeranthus indicus Linn. In Albino Rats. Global Journal of Pharmacology, 3(1): 32-37.
14. Bahmani, M., S. Forouzan, M. Rafieian-K opaei, M. Avijgan, S. Hosseini, P. Parsaei, H. Golshahi and Z. Eftekhari, 2012. American-Eurasian J. Agric. & Environ. Sci., 12: 1490-1495.
15. Fatteh, U.G., N.A. Patel, F.P. Chaudhari, C.J. Dangaria and P.G. Patel, 1995. Heterosis and combining ability in sesame. J. Oilseeds Res., 12(2): 184-190.
16. Hassan, M.A.M., 2012. Studies on Egyptian Sesame Seeds (Sesamum indicum L.) and Its Products 1- Physicochemical Analysis and Phenolic Acids of Roasted Egyptian Sesame seeds (Sesamum indicum L.). World Journal of Dairy & Food Sciences 7: 195-201.

17. Hassan, M.A.M., 2013. Studies on Egyptian Sesame Seeds (Sesamum indicum L) and its Products. 2. Effect of Roasting Conditions on Peroxide Value, Free Acidity, Iodine Value and Antioxidant Activity of Sesame Seeds (Sesamum indicum L.). World Journal of Dairy & Food Sciences, 8: 11-17.
18. Hassan, M.A.M., 2013. Studies on Egyptian Sesame Seeds (Sesamum indicum L.) and its products. 3.Effect of Roasting Process on Gross Chemical Composition, Functional Properties, Antioxidative Components and Some Minerals of Defatted Sesame Seeds Meal (Sesamum indicum L.) World Journal of Dairy & Food Sciences, 8: 51-57.
19. Darvishi, H., 2012. Moisture-Dependent Physical and Mechanical Properties of White Sesame Seed. American-Eurasian J. Agric. & Environ. Sci., 12: 198-203.
20. Adebowale, A.A., S.A. Sanni and O.A. Falore, 2010. Varietal Differences in the Physical Properties and Proximate Composition of Elite Sesame Seeds. Libyan Agriculture Research Center Journal International, 1: 103-107.
21. Tocher, J.F., 1891. Isolation of another substance from sesame oil. Pharm. J. Transactions, 3: 639-640.
22. Budowski, P., 1950. Sesame oil. III. Antioxidant Properties of Sesamol. J. Am. Oil Chem. AmSoc., 27: 264267.
23. Fukuda, Y., M. Nagata, T. Osawa and M. Namiki, 1986. Contribution of lignan analogues to antioxidative activity of refined unfrosted sesame seed oil J. Am. Oil Chem. Soc., 60: 501-509.
24. Hirose, N., F. Doi, T. Ueki, K. Akazawa, K. Chijiiwa, M. Sugano, K. Akimoto, S. Shimizu and H. Yamada, 1992. Suppressive effect of sesamin against 7, 12-dimethylbenzene (a) anthracene induced rat mammary carcinogenesis. Anticancer Res., 12: 1259-1266.
25. Shimizu, S., K. Akimoto, Y. Sninmen, H. Kawashima, M. Sugano and H. Yamada, 1991. Sesamin is a potent and specific inhibitor of 5 desaturase in polyunsaturated fatty acid biosynthesis. Lipids, 26: 512-516.
26. Hirose, N., T. Inoue, K. Nishihara, M. Sugano, K. Akimoto, S. Shimizu and H. Yamada, 1991. Inhibition of cholesterol absorption and synthesis in rats by sesamin. J. Lipids Res., 32: 629-638.
27. Akimoto, K., Y. Kitagawa, T. Akamatsu, N. Hirose, M. Sugano, S. Shimizu and H. Yamada, 1993. Protective effect of sesamin against liver damage caused by alcohol or carbon tetrachloride in rodents. Ann. Nutr. Metab, 37: 218-224.
28. Chavali, S.R., T. Utsunomia and R.A. Forse, 2001. Increased survival after cecal ligation and puncture inmice consuming diets enriched with sesame seed oil. Crit. Care. Med., 29: 140-143.
29. Matsumura, Y., S. Kita and S. Morimoto, 1995. Antihypertensive effect of sesamin. I. Protection against deoxycorticosterone acetate-salt-induced hypertension and cardiovascular hypertrophy. Biol Pharm Bull., 18: 1016-1019.
30. Chitravadivu, C., M. Bhoopathi., V. Balakrishnan, T. Elavazhagan and S. Jayakumar, 2009. Antimicrobial Activity of Laehiums Prepared by Herbal Venders, South India. American-Eurasian Journal of Scientific Research, 4: 142-147.
31. Hajimahmoodi, M., M.R. Oveisi, N. Sadeghi, B. Jannat, Z. Bahaeddin and S. Mansoori, 2008. Gamma Tocopherol Content of Iranian Sesame Seeds, Iranian Journal of Pharmaceutical Research, 7(2): 135-139.
32. Gerald, S.L., M.C. Diane, R.K. David, J.M. David, E.P. Roger and R. George, 1994. Definitions and guidelines for assessment of wounds and evaluation of healing Wound Repair and Regeneration, 2: 165-170.
33. Phillips, G.D., R.A. Whitehe and D.R. Kinghton, 1991. Initiation and pattern of angiogenesis in wound healing in the rats. American J Anatomy, 192: 257-262.
34. Selvam, R., L. Sumramanian, R. Gayathri and N. Angayarkanni, 1995. The antioxidant activity of turmeric (Curcuma longa). J Ethanopharmacol, 47: 59-67.
35. Pascoe, G.A., M.W. Fariss, K. Olafsdottir and D.J. Reed, 1987. A role of vitamin E in protection against cell injury: Maintenance of intracellular glutathione precursor and biosynthesis. Eur J Biochem, 166: 241-247.
36. Khanna, S., M . Venojarvi, S. Roy, N. Sharma, P. Trikha, D. Bagchi, M. Bagchi and C.K. Sen, 2002. Dermal wound healing properties of redox-active grape seed proanthocyanidins. Free Rad Biol Med., 33: 1089-1096.
37. Gomathi, K., D. Gopinath, A.M. Rafiuddin and R. Jayakumar, 2003. Quercetin incorporated collagen matrices for dermal wound healing processes in rats. Biomaterials, 24: 2767-72.