



A comparison of wound healing activity following treatment with three types of Yemen's honey on excision wounds in rats: an animal model

Dr. Nidhal Ali A. Wahid *

* College of Dentistry /AL- Mustansiria University

Abstract

Four groups of adult Wistar Kyoto rats each consist of 6 animals. The rats were experimentally wounded in the posterior neck area. Wounds of Group 1 rats were kept without treatment throughout the experiment. Wounds of Group 2, 3 and 4 were topically applied with fresh unprocessed Yemen's honey *Al-Dawa'ani*, *Al-Jardani* and *Al-Jawahi*, respectively. The rates of wound healing were assessed in all animals. Wounds treated with honey *Al-Dawa'ani*, *Al-Jardani* and *Al-Jawahi*, significantly healed earlier and much faster as compared to wounds of Group 1 animals. Wounds of Group 4 animals treated with honey *Al-Jawahi*, significantly accelerate wound healing compared to wound treated with honey *Al-Dawa'ani* or *Al-Jardani*. There were no significant differences between honey *Al-Dawa'ani* and honey 2 *Al-Jardani* in the term of duration of wound healing. Histologically, dermal wounds treated with honey *Al-Dawa'ani*, *Al-Jardani* and *Al-Jawahi*, were rapidly replaced by granulation tissue and advancing epithelialization compared to wound of Group 1 rats. These results indicated the beneficial effects of honey *Al-Jawahi* for the acceleration of wound healing process in rats.

KEYWORDS: Honey *Al-Dawa'ani*, *Al-Jardani* and *Al-Jawahi*, wound healing, histology

Introduction

Honey has long been used to accelerate wound healing (1, 2, 3). Honey as an excellent adjuvant for acceleration of wound healing is widely accepted in folk medicine. Existing literature attributes honey with a number of useful properties, such as a broad-spectrum antimicrobial activity, deodorization, debriding and anti-inflammatory actions and stimulation of new tissue growth (4). Honey, for the most part, is made up of simple sugars and is an excellent source of energy. It is hypertonic and has been shown to be sterile and highly bactericidal (5). Honey has been found, when applied locally, to reduce infection and promote wound healing (6). Physiological properties of honey such as

hyper tonicity, low pH and hygroscopic were thought to augment the healing process. Antibacterial effects were also attributing to these elements (7). Yemen's honey is reputed throughout the world for its high quality and is among the worlds most famous due to Yemen's diverse terrain of high mountains, vast valleys, spacious plateaus and lengthy coast. This gives Yemen a unique climate enriching the quality of its year-round botanic yield. Yemen's kaleidoscopic nature produces rich blossom varieties and various types of honey. Yemen possesses many of the best kinds of honey. The most famous ones are: "*Al-Dawa'ani*" that is found in Dawa'an, Hadramout, "*Al-Jardani*" in Shabwa, "*Al-Jawahi*" in Awash, Dhamar and there are also some good kinds of

honey found in Al-Kibbayta, Al-Dimna, and Maweyah in Taiz. "Al-Dawa'ani" is the most expensive kind of honey in Yemen and the best in quality. The present study carried out to assess the wound healing activity of Yemen's honey *Al-Dawa'ani*, *Al-Jardani* and *Al-Jawahi* on excision dermal wounds in rats.

Materials and methods

Honey

Pure, unprocessed, un-boiled commercial Yemen's honey *Al-Dawa'ani*, *Al-Jardani* and *Al-Jawahi*, was obtained from the market were used for the present study.

Experimental animals

Wistar Kyoto rats were obtained from the animal house, faculty of medicine, University of Malaya. The rats were divided randomly into 4 groups of 6 rats each. Each rat that weighted between 150-200 gm was housed separately (one rat per cage). The animals were maintained on standard pellet diet and tap water.

Experimentally induced wounds

The animals were anesthetized by diethyl ether. The skin shaved, disinfected with 70% alcohol and injected with 1 ml of Lignocaine HCl (2%, 100 mg/5 ml). An area of uniform wound 2 cm in diameter was excised from the nape of the dorsal neck of all rats with the aid of round seal as described by (8) (Figure 1). Avoid incision of the muscle layer and tension of skin was kept constant during the procedure.

Topical application of vehicles

Group 1 animals were kept as control without treatment. Honey Yemen's honey *Al-Dawa'ani*, *Al-Jardani* and *Al-Jawahi* were applied topically twice daily to the wounds of Group 2, 3 and 4 rats, respectively. The wound was observed daily until complete wound-healing process occurs.

Statistical analysis

All values are reported as mean + S.E.M. and the statistical significance of differences among groups were assessed using one-way ANOVA. A value of $P < 0.05$ was considered significant.

Results

Wounds treated with Yemen's honey *Al-Dawa'ani*, *Al-Jardani* and *Al-Jawahi*, showed considerable signs of dermal healing and significantly ($P < 0.05$) decrease mean wound healing time compared to wounds of Group 1 animals (Table 1; Figure 2 and Figure 3). Wounds treated with honey *Al-Jawahi* significantly possesses better healing and healed faster compared to wounds treated with honey *Al-Dawa'ani*, *Al-Jardani*. There were no significant differences between wounds treated with honey *Al-Dawa'ani*, *Al-Jardani* in the term of duration of wound healing (Table 1). Histologically, wound treated with honey characterized by rapid epithelization, granulation and less scar formation. However, wounds of control animals (Group 1) characterized by delayed epithelization, granulation and large scar formation (Figures 4 and 5).

Discussion

The results of the present study showed that the used of honey as topical applicants significantly accelerated wound healing compared to Group 1 animals. The wound healing properties of honey had been well documented (9, 3). Topical application of honey has been recognized for a long time to be effective in controlling infection and producing a clean granulating wound bed. Honey acts mainly as a hyperosmolar medium and prevents bacterial growth. The high sugar content of honey renders it hyperosmolar. Due to this, it causes rapid absorption of edema fluid from the soggy weeping wounds. The viscosity of honey is high and it forms a physical barrier that

prevents bacterial colonization of wounds and creating a moist environment which appears to be a helpful and accelerates wound healing. (10). The nutrient contents of the honey such as laevulose and fructose improve local substrate supply and may help promote epithelialization (1). Honey seems to cause more rapid epithelialization, presumably because of antibacterial properties.

The antibacterial activity of honey is due mainly to an inhibine factor, which is hydrogen peroxide, an end product of the enzymatic reaction of glucose oxidase (from the bee) with glucose in diluted honey. This help in debridement of the wound due the Fenton reaction, it can easily produce free hydrogen radicals with a bactericidal effect (11). The enzyme catalase present in honey has an antioxidant property (12) and thus honey may have a role as an anti-oxidant in thermal injury (13). In conclusion, honey *Al-Jawahi*, appears to have several important properties that make it ideal as a dressing agent for almost every type of wounds.

Acknowledgments

I wish to express my sincere thanks to Associate professor Dr. Mahmood Amin Abdul All Department of Molecular Medicine, Faculty of Medicine, University of Malaya for his cooperation, support and his scientific consultations, continued advice and offering his experience to perform this research.

References

- 1- Hone, J. (2005). Using honey to heal a chronic wound in a patient with epidermolysis bullose. *Br. J. Nurs.* 14: 54-55.
- 2- Lusby, P.E., Coombes, A.L., and Wilkinson, J.M. (2006). A comparison of wound healing following treatment with *Lavandula x allardii* honey or essential oil. *Phytother Res.* 20: 755-757.
- 3- Molan, P.C. (2006). The evidence supporting the use of honey as a wound dressing. *Inter. J. Low. Extrem. Wounds* 5:40-54.
- 4- Dunford, C., Cooper, R., Molan, P. and White, R. (2000). The use of honey in wound management. *Nurses Standard*, 15: 63-68
- 5- White, J.W., Subers, M.H. and Schepartz, A.I. (1963). The identification of inhibine. The antibacterial factoring honey as hydrogen peroxidase and its origin in a honey glucose oxidase system. *Biochemical Biophysiology Acta*, 73: 57-70.
- 6- Al-Waili, N.S and Saloom, K.Y. (1999). Effects of topical honey on post-operative wound infections due to Gram positive and Gram negative bacteria following Caesarean sections and hysterectomies. *European Journal of Medical Research*, 4: 126-130.
- 7- Inqle, R., Levin, J. and Polinder, K. (2006). Wound healing with honey-a randomized controltrial. *South Afr. Med.* 96:831-835.
- 8- Morton, JJ & Molane MH 1972, 'Evaluation of vulnerary activity by an open wound procedure in rats,' *Archives Internationales de Pharmacodynemiie et de Therapie*, vol. 196 no. 1, pp. 117-126.
- 9- McIntosh, C.D. and Thomson, C.E. (2006). Honey dressing versus paraffin tulle gras following tonenail surgery. *J. Wound Care* 15:133-136.
- 10- Subrahmanyam, M. (1991). Topical application of honey in treatment of burns. *British Journal of Surgery*, 78: 497-498.
- 11- White, R. (2005). The benefits of honey in wound management. *Nurs Stand.* 20:57-64.
- 12- Schapartz, A.I. and Subers, M.H. (1996). Catalase in honey. *Journal of Agricultural Research*, 5: 37-43.
- 13- . Subrahmanyam, M. (1996). Honey dressing versus boiled potato peel in the treatment of burns: a prospective randomized study *Burns*, 22: 491-493.

Table 1: Time required for wound healing by honey *Al-Dawa'ani*, *Al-Jardani* and *Al-Jawahi* in experimental animals

Animal groups	No of animals	Type of dressings(Honey)	Healing time (days) (Mean±S.E.M)
Group 1	6	Control (without treatment)	21.83±0.48 ^a
Group 2	6	Honey <i>Al-Dawa'ani</i>	15.17 ±0.60 ^b
Group 3	6	Honey <i>Al-Jardani</i>	15.33±0.31 ^b
Group 4	6	Honey <i>Al-Jawahi</i>	12.00 ±0.52 ^c

All values were expressed as mean and + standard error mean. Mean with different superscripts were significantly different ($P<0.05$)



Figure 1: 2 cm diameter excision skin wound on day 0 before application of vehicle

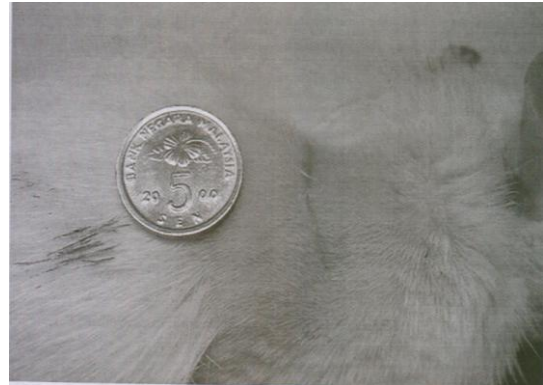


Figure 2. Complete wound healing with honey *Al-Jawahi* on day 12.



Figure 3: Wound healing on day 20 in control animal (without treatment)

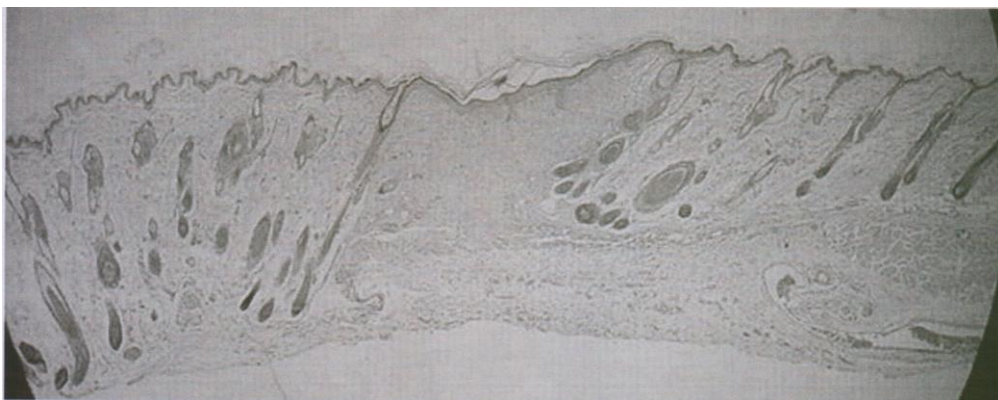


Figure 4: Histological section of heated wound treated with honey *Al-Jawahi* on day 12, characterized by rapid epithelization, granulation and mild scar formation. (H&E stain, 40x)