

*Research Article***The Use of Natural Honey in the Management of Diabetic Foot Ulcers****Omar Eissa***, **Gamal S. Saleh***, **Ragab M. Aly***, **Nabeel A. Aly**** and **Mohamed Rabee***

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Abstract

Objective: This study was performed to compare dressings with honey/normal saline to povidone iodine/hydrogen peroxide in the management of diabetic foot ulcers. Diabetic ulcers seem to be arrested in the inflammatory/proliferative stage of the healing process, allowing infection and inflammation to preclude healing. Antibiotic-resistant bacteria have become a major cause of infections, including diabetic foot infections. It is proposed here that the modern developments of an ancient and traditional treatment for wounds, dressing them with honey, provide the solution to the problem of getting diabetic ulcers to move on from the arrested state of healing. Honey selected to have a high level of antibacterial activity have been shown to be very effective against antibiotic-resistant strains of bacteria in laboratory and clinical studies. The potent anti-inflammatory action of honey is also likely to play an important part in overcoming the impediment to healing that inflammation causes in diabetic ulcers, as is the antioxidant activity of honey. The action of honey in promotion of tissue regeneration through stimulation of angiogenesis and the growth of fibroblasts and epithelial cells, and its insulin-mimetic effect, would also be of benefit in stimulating the healing of diabetic ulcers. **Methods:** four hundred patients with diabetic foot ulcers were allocated randomly to two groups according to the dressing material used. The study was performed between 2004-2012 in four district hospitals in Egypt and Yemen. **Results:** The study showed that introducing honey/normal saline as a method of dressing reduced time of the healing, hospital stay and cost by 34%, 43%, 0.7%, respectively. The need for amputations was also reduced by 0.0%. The dressing material irritation and allergy were markedly reduced in comparison with povidone iodine/ hydrogen peroxide. **Conclusion:** The use of honey and normal saline protocol appeared to reduce the time of healing, hospital stay and the need for amputation. It is non-irritant, has antimicrobial effect and a debriding action. It also promotes healing, and is cost effective in the management of diabetic foot ulcers.

Key words: Honey, povidone iodine, Diabetic foot ulcer.**Introduction**

Finding a dressing that provides an optimal wound healing environment for the patient and is also cost-effective can be a difficult process⁽¹⁾. This is particularly true for hard-to-heal wounds, which are associated with long duration and a high incidence of complications, often resulting in considerable quality of life and financial burdens⁽²⁾. Ancient remedy has been rediscovered for the use of honey as a wound dressing material. Efeem showed that various types of wounds and skin ulcers, which had not responded to conventional methods of

treatment such as antibiotics and medicated dressings, responded favourably to topical

honey treatment⁽³⁾. Iodine compounds (povidone iodine and cadexomeriodine), chlorhexidine, hydrogen peroxide, acetic acid, and silver compounds were also used as dressing agents⁽⁴⁾. Despite attempts at prophylaxis, foot ulcers remain a frequent complication of diabetes. Delayed or inadequate treatment of foot infections in diabetic patients often results in limb loss and the management of the complicated lesions can be both challenging and

rewarding so the correct treatment and dressing material used for diabetic foot ulcers remains under estimated. The aim of the study was to compare the effect of the use of honey/normal saline combination with povidone iodine/hydrogen peroxide combination in vivo regarding the time of healing, hospital stay, and cost and to avoid the need for amputation and dressing material irritation.

Considering that the research on tissue-engineered skin substitutes was started approximately 20 years ago yet this form of therapy (honey /normal saline combination) has barely started to get into regular clinical practice, there is obviously an immediate need for an effective therapy for chronic diabetic ulcers. It is proposed here that the modern developments of an ancient and traditional treatment for wounds, dressing them with honey, have allowed this immediate need to be met.

Materials and Methods

From 2004-2012, four- hundred and eight consecutive patients with diabetic foot ulcers who were admitted to the surgical departments in four district hospitals in Egypt and Yemen, were treated using two different methods. Eight patients, who died during the study period from other medical illness, were excluded. Patients were randomly allocated into two groups, after an informed consent had been obtained. Age, sex distribution were similar in the two groups (Table I) as was the number of ulcers per patient, intravenous antibiotics and surgical debridement under general anesthesia.

Povidone iodine / hydrogen peroxide dressing method (Group I)

Wounds were debrided under aseptic technique followed by washing with povidone iodine and hydrogen peroxide in a ratio of 3:1, then packed with soaked gauze of the same solution and covered with occlusive or absorbent secondary dressings. Three times daily dressing changes were applied, then declined as the treatment progresses until healing was achieved.

Honey and normal saline dressing methods (Group II)

Debridement was done in a similar manner to group I and washed with normal saline, then

packed with Egyptian and Yemen natural honey impregnated gauze and occlusive or absorbent, secondary dressings were needed to prevent honey oozing out from the wound dressing. Three times daily dressing changes were applied, then declined as the treatment progresses until healing was achieved, similar to group I Differences in healing, hospital stay and cost were analyzed using T test.

Amputation, positive culture swab and allergy were evaluated using Chi-square. Statistical significance was also calculated.

Results

There were 400 patients involved in the study, 224 males and 176 females with a mean age of 68 years. The patients were divided equally into two groups according to the treatment method (Table I), the mean healing time was 32 (9-90) days in group I compared to 21 (9-90) days in group II while, the hospital stay was 23 (9-90) days in group I compared to 13 (9-42) days. The hospital staying was reduced by 43% ($P < 0.001$) and healing time was reduced by 35% ($P < 0.001$) in group II compared to group I (Table II). Honey/normal saline was applied to 20 patients from group I who failed to respond to povidone iodine /hydrogen peroxide dressing method within the duration of the study. Dramatic improvement was achieved in 16 of them within three weeks, and the remaining four eventually underwent amputation. Unfortunately, a number of patients deteriorated and needed amputation, 40 cases of group I (toe amputation 24, below knee 14, above knee 2), compared to 20 in group II (12, 6, 2) respectively, so the percentage was reduced by 50% ($P < 0.05$). Culture swabs were taken from all patients weekly in group I. 76 patients became clean within one week, 86 within two weeks and the remaining 38 patients within six weeks, while in group II, 140 patients became clean within one week, 24 patients within two weeks, and the remaining 36 patients within four weeks ($P < 0.001$).

Out of the 400 patients 280 showed mixed growth, 80 had pseudomonas colonization and 40 had Eschereriacoli. 120 patients with antibiotic-resistant strains were divided equally between the two groups; wounds became clean

in 10 patients in group I compared to 30 patients in group II by the seventh day of treatment. The number of patients showing irritation and allergy to povidone iodine/hydrogen peroxide was 28 while none had allergy to honey/normal saline ($P < 0.001$). It was noted that honey dressing was easier to apply and remove with normal saline without adhesions, damage to the granulation tissue or bleeding, compared to those on conventional treatment.

The cost of treatment was evaluated in both groups and showed reduction from 520

(American Dollar; 3120 Egyptian pound (EP); 111800 Yemen Rial (YR) to 260 \$ (1060 EP; 50900 YR) in uncomplicated cases and from 1000 \$ (6000 EP; 21000 YR) to 480 \$ in complicated cases (50% in uncomplicated patients and 52% in complicated patients ($P < 0.001$)) (Table IV).

Complicated cases were defined as those patients who need amputation within the study period or/and patients with positive culture for antibiotic resistant strains.

Table I: Patients data.

	Group I (n=200)	Group II (n=200)
Sex (Male: Female)	124/76	116/84
Age(Years)	32-90	30-90
Mean Number of Ulcers/patient	2.1	1.8
Debridement under General Anesthesia	160	104

Table II: Healing and hospital stay in days.

	Group I	Group II	P value
Time of healing	7-90	7-70	P < 0.001
Median	32	21	
SD	20.89	10.97	
Hospital stay	7-56	7-42	P < 0.001
Median	23	13	
SD	14.04	8.26	

Table III: Patients negative wound swab culture (clean wounds) and treating time.

	Group I	Group II	P value
Admission day	0	0	P value < 0.001
7	76	140	
14	86	24	
21	18	20	
28	10	16	
35	8	0	
42	4	0	

Table IV: Dressing Type and Treatment Cost.

Mean Cost in American Dollar	Group I	Group II	P value
Non complicated patient	520 \$	260 \$	P value < 0.001
Complicated patient	1000 \$	480 \$	
SD	192.97	77.33	
Mean	716 \$	282 \$	



Picture 1



Picture 2



Picture 2

Discussion

Diabetic foot complications are the most common cause of non-traumatic lower extremity amputations in the industrialized world, the risk of lower extremity amputations is 10-46 times higher in diabetics than in non-diabetics⁽⁶⁾. Honey has been used to treat infections in a wide range of wound types (burns, venous leg ulcers of mixed etiology, diabetic foot ulcers, unhealed graft donors, abscesses, boils, pilonidal sinuses and necrotizing fasciitis)^(3,7). Several studies showed that honey had the ability to provide a protective barrier to prevent cross infection and to create an antibacterial moist healing environment, which rapidly clears infecting bacteria including antibiotic-resistant strains⁽¹⁾. In the “rediscovery” of the use of honey for wound care there has been a lack of awareness of some ancient wisdom. Four millennia ago the Ancient Egyptians mixed cotton fibres and fat into honey to create a dressing that would hold the honey on a wound⁽⁸⁾.

As the population ages, underlying pathologies (e.g. renal failure, hypertension, etc) become more complex and their influence on healing means that wounds are more likely to become chronic⁽⁴⁾. With an increasing problem of antibiotic resistance worldwide^(1,11), honey-based products could be an attractive alternative, as, to date, no bacterial resistance to honey has been reported⁽¹¹⁾.

Studies have shown that honey has the debriding effect by osmotic action which causes an outflow of lymph, lifting debris from the wound bed, rapidly removes mal odour, promoting healing stimulating tissue regeneration, is non-adherent and therefore minimizes healthy tissue trauma, allergy, irritation and pain during dressing changes and reduces oedema by its anti-inflammatory action^(12,14). Similar results were obtained in our study. Other studies showed that many patients had unhealed ulcers due to different causes and were not improved by conventional treatment, although good results were achieved when honey application was used⁽¹⁴⁾, similar results were noticed in our study.

Hydrogen peroxide concentration in honey is around one mmol/litre, while it is around one thousand mmol/litre in the standard 3% solution, which has been found to be harmful to wounds when added as a rinse solution. On the other hand, honey proved to prevent bacterial growth through its acidic pH (pH 3.7)⁽¹⁴⁾.

Honey is also an ideal first-aid dressing material, especially for patients in remote locations when there could be time for infection to have set in before and after medical treatment is obtained, it is readily available and simple to use. It would be particularly suitable for first aid treatment for diabetic foot ulcers.

Conclusion

Using honey in wound treatment is documented. No toxic effects have been reported in the literature compared to povidone iodine/hydrogen peroxide and many studies support the clinical safety and efficacy of honey. Significant experimental data proved the antibacterial properties and histological effect of honey on a wide range of bacteria even antibiotic-resistant strains.

Furthermore, our study shows that the healing and hospital stay time were shorter with honey/normal saline than povidone iodine/hydrogen peroxide. Using honey/normal saline significantly reduced amputations, wound dressing irritation, adhesion and treatment costs, and thus we strongly recommend the use of honey/normal saline for successful treatment of diabetic foot ulcers.

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