



“A Comparative Study Between Honey Dressing and Local Application of Insulin in Wound Healing for Diabetic Foot Ulcers”

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KEYWORDS

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ABSTRACT:

Introduction:

Diabetic foot ulcers (DFUs) remain a major cause of morbidity, amputations, and mortality in patients with diabetes. Optimal wound management strategies are crucial for reducing complications and enhancing outcomes. Honey and local insulin have both been reported to enhance wound healing, but comparative clinical evidence is limited.

Aim:

To compare the effectiveness of honey dressing and topical insulin application in the healing of diabetic foot ulcers.

Materials and Methods:

A hospital-based prospective study was conducted on 50 patients with DFUs admitted to a tertiary care surgical ward. Eligible patients were randomized into two groups: Group A received honey dressings, and Group B received topical insulin dressings. Wounds were assessed on days 0, 7, 14, 30, and 90 using standardized wound area measurements and Wagner’s grading. Data was analyzed using chi-square/Fisher’s exact test.

Results:

Of the 50 patients, 74% were male, with a mean age of 55.7 years in Group A and 52.6 years in Group B. Wound cultures revealed common pathogens, including *Pseudomonas*, *Staphylococcus aureus*, and *Enterococcus*. Healing within 30 days was observed in 52% of patients in the honey group compared to 8% in the insulin group. By day 90, 96% of honey-treated wounds healed versus only 28% in the insulin group ($p < 0.001$). Honey dressings also showed faster slough clearance and reduced need for surgical interventions.

Conclusion:

Honey dressings were significantly more effective than topical insulin in promoting wound healing in DFUs, offering a cost-effective, safe, and readily available treatment option.



1. INTRODUCTION:

Diabetes mellitus is a complex metabolic disorder characterized by chronic hyperglycaemia resulting from impaired insulin secretion, action, or both^{1,3}. Among its many complications, diabetic foot ulcers (DFUs) represent one of the most debilitating, often leading to severe infections, amputations, and increased mortality^{4,6}. The pathogenesis of DFUs involves peripheral neuropathy, peripheral vascular disease, and impaired immunity, which together compromise wound healing^{7,9}. Globally, DFUs affect approximately 15–25% of individuals with diabetes during their lifetime, posing a major socioeconomic burden^{10,11,12}.

Effective management of DFUs requires glycaemic control, infection management, surgical debridement, and appropriate wound care^{13,15}. Conventional dressings provide limited benefit; thus, biologically active agents like honey and topical insulin have gained attention^{16,17}. Honey has been used since antiquity for wound healing due to its high osmolarity, hydrogen peroxide release, and broad antimicrobial activity^{18,19,20,21}. Clinical studies demonstrate its efficacy in reducing bacterial colonization, accelerating granulation tissue formation, and enhancing epithelialization^{22,23,24}.

Similarly, insulin, discovered in 1921, has been explored for topical wound management since the 1930s^{25,26}. Insulin promotes keratinocyte proliferation, angiogenesis, and collagen deposition, thereby enhancing healing independent of systemic glycaemic control^{27,29}. Experimental and clinical evidence support its role in accelerating the repair of chronic wounds^{30,31,32}. However, direct comparisons between honey and insulin in DFU management remain scarce, necessitating robust clinical evaluation. This study aims to compare the effectiveness of honey dressing versus local insulin application in promoting wound healing among patients with DFUs.

2. SUBJECTS AND METHODS:

Hospital-based study - Patients admitted to a tertiary hospital in the general surgery ward, having diabetes mellitus with ulcers over the lower extremities.

Method of collection of data:

All patients who were admitted to the surgical ward at tertiary hospitals with complaints

of an ulcer on the lower leg with diabetes were enrolled for the study after obtaining informed consent.

Sample and Sampling technique:

Sample size- 50

Sampling technique- Stratified selective sampling

3. METHODOLOGY

The patients were divided into two groups

1. Patients receiving a honey dressing
2. Patients receiving local application of insulin

An impression of the wound will be taken on a clean, sterile transparency sheet, the margins will be marked, and 2 measurements in the longest & the widest dimensions will be taken. Also, the wound tracing will be extrapolated onto a graph sheet to record the mean area of the wound. These coordinates will be kept constant throughout the wound healing process. The recordings will be made on day 0, day 7, day 14 and day 90 or till complete healing of the wound, whichever is earlier.

3. Surgical toileting of the wound if needed, or other minor surgical interventions to optimise the healing process were done if required.
4. In Group A, ulcers were cleaned with normal saline and honey was applied and the wound was covered with sterile gauze. In Group B, ulcers were cleaned with normal saline, and then 10 units of human Actrapid insulin for an ulcer of size 10 cm² was sprayed daily with an insulin syringe, and the ulcer was left to dry and then covered with sterile cotton gauze.
5. The data thus collected were statistically analysed by applying various statistical tests to compare the efficacy of both types of dressing

Inclusion criteria:

1. Patients with type 1 & type 2 DM, known cases on treatment as well as recently detected cases, of both sexes.
2. Patients with DM having ulcers over the lower



extremities, i.e. below the knee.

Exclusion criteria:

1. Patients who have been operated on for Diabetic foot infections earlier
2. Ulcers of Wagner's grade V
3. X-rays showing features of osteomyelitis
4. Doppler showing gross atherosclerotic arterial changes and venous abnormalities like varicosities
5. Malnutrition and uncontrolled diabetes
6. Other clinically significant medical conditions that would impair wound healing, including renal, hepatic, haematological, neurological and immunological diseases.
7. Patients receiving corticosteroids, immunosuppressive agents, radiation, or chemotherapy within one month before entry into the study were also excluded

Plan for Data Analysis:

Collected data was evaluated with the chi-square/Fisher's exact test p

Ethics:

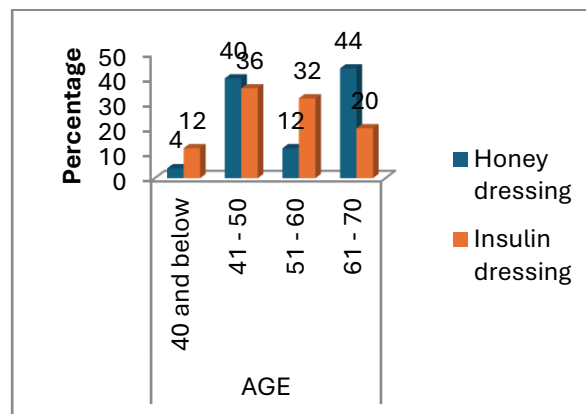
The study was approved by the Institutional Ethics Committee before patient enrolment.

4. RESULTS AND ANALYSIS

The study was conducted over a period of 2 years at a tertiary hospital in the surgical ward. Of the total 100 patients who were screened, the study group involved 50 (50%) patients; the remaining 50 (50%) patients were excluded due to the following reasons (exclusion criteria).

1. 10 patients had varicose vein ulcer
2. 13 patients had peripheral neuropathy
3. 15 patients had peripheral Vasculopathy
4. 12 patients underwent AKA/BKA

Fig 1: AGE WISE DISTRIBUTION (in yrs)



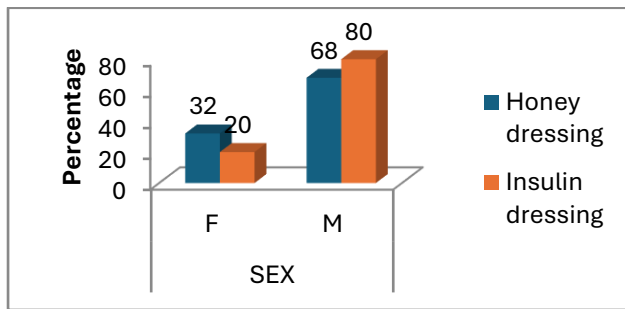
In the total sample, the mean age of patients in group A is 55.72 with a standard deviation of 11.845, and in group B, the mean age was 52.68 with a standard deviation of 8.793. The study group underwent initial assessment as per the proforma & evaluation in terms of standard laboratory investigations and radiological screening (foot x-ray) if need be. Patients fulfilling the inclusion criteria were randomized prospectively into two groups, Group A and Group B. Group A received a Honey dressing, and Group B received an Insulin dressing. All diabetic patients were brought under glycaemic control with appropriate antidiabetic therapy. Before enrolling the patients for the study, culture and sensitivity swabs of all the ulcers were taken, and the ulcers were cleaned with normal saline. Surgical debridement of dirty wounds was done under anaesthesia. Then the ulcers were included in the study. Time required for preparing the ulcers from the time of admission till enrolment in the study was considered as wound preparation time. While considering the hospital stay of patients, this wound preparation time was not considered. At admission, all patients were treated with appropriate antibiotics, which were later changed as per pus culture and sensitivity reports.

Initially, a broad-spectrum antibiotic was started & later switched over to specific antibiotics depending on the cultures grown from the pus and their sensitivity pattern. An impression of the wound will be taken on a clean, sterile transparency sheet; the margins will be marked, and 2 measurements in the longest & the widest dimensions will be taken. Also, the wound tracing was extrapolated onto a graph sheet to record the mean area of the wound. These coordinates were kept constant



throughout the wound healing process. The recordings were made on day 0. (i.e. on the day of admission), day 7, day 14, day 30 and day 90 or till complete healing of the wound, whichever is earlier.

Fig 2: SEX DISTRIBUTION CHART



Out of the 50 patients in the study group, 37 (74%) were male and 13 (26%) were female

Fig 3A: COMPLICATION OF DIABETES

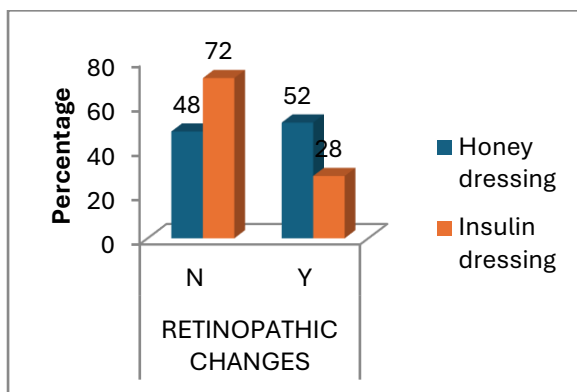
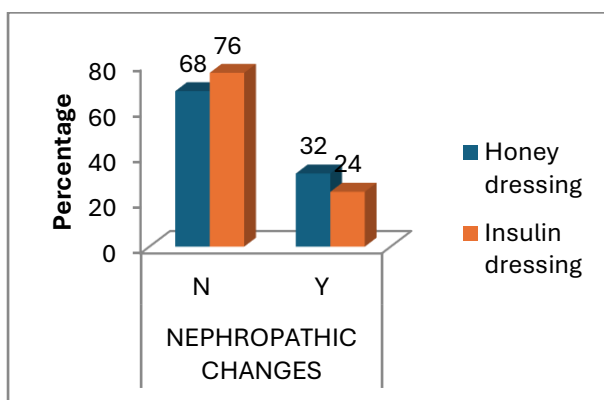


Fig 3B: COMPLICATION OF DIABETES



Out of the 50 patients, 23 (46%) had either retinopathy or nephropathy as a complication

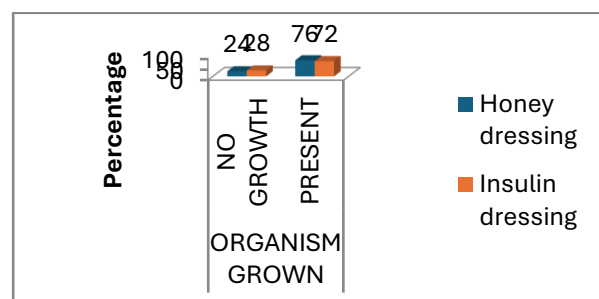
secondary to long-standing diabetes, whereas 27 (44%) did not have either. In the total of 50 patients, 9 (18%) patients had retinopathy alone, 3 (6%) patients had nephropathy alone, and 11 (22%) patients had both retinopathy and nephropathy. Patients with diabetic peripheral neuropathy were not a part of the study group.

Culture & Sensitivity of the pus swab taken from these patients at the time of admission showed a variety of bacterial growth, with Pseudomonas, Enterococci & Staph aureus being the most isolated species. The other species were Proteus, Klebsiella, E coli, Citrobacter, Acinetobacter & MRSA as other species in the descending order of their growth. 12 (24%) patients of the 50 had a polybacterial growth pattern.

Table 1: DIFFERENT ORGANISMS ISOLATED FROM THE WOUND

BACTERIAL GROWTH	No OF PATIENTS
PSEUDOMONAS	8
KLEBSIELLA	5
PROTEUS	7
STAPH AUREUS	8
ENTEROCOCCUS	8
E. COLI	5
ACINITOBACTER	2
MRSA	1
CITROBACTER	2
NO GROWTH	13

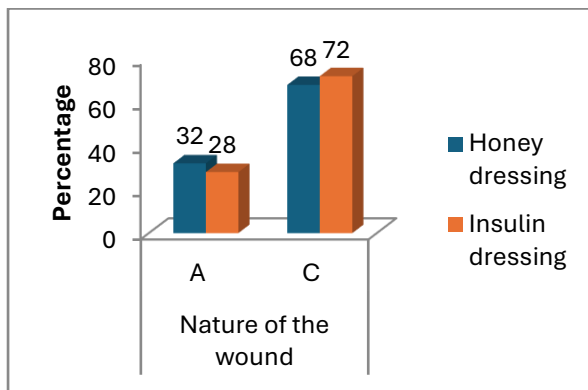
Fig 4: BACTERIAL GROWTH





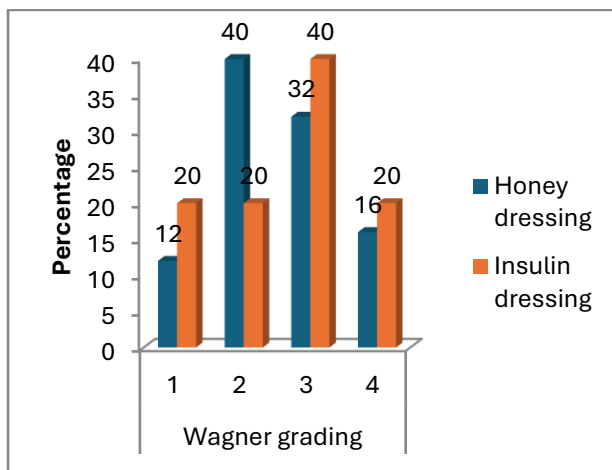
19 patients (76%) with honey dressing showed bacterial growth, while bacteria were isolated from 18 patients (72%) with insulin dressing

Fig 5: NATURE OF WOUND



Out of 50 patients, 8 patients (32%) with honey dressing and 7 patients (28%) with insulin dressing had wounds of acute onset. 18 patients (68%) with honey dressing and 17 patients (72%) with insulin dressing had wounds of chronic onset.

Fig 6: WAGNER'S GRADING OF WOUND



The foot wounds were classified based on Wagner's classification of diabetic wounds. Wagner's grade 4 was seen in 4 patients (16%) with a honey dressing and 5 patients (20%) with an insulin dressing.

Healing time for Group A (Honey dressing) and Group B (insulin dressing)

TABLE 3: HEALING TIME IN BOTH GROUPS

Days at Healing	Group A No of Patients	Group B No of Patients
Within 15 days	1	0
Between 15-30 days	12	2
Between 30-90 days	11	5

Fig 7: DAYS OF HEALING

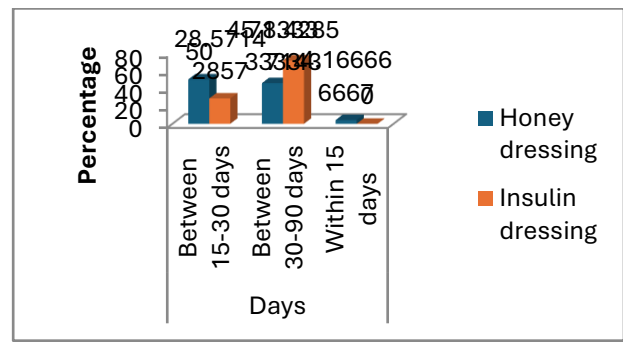
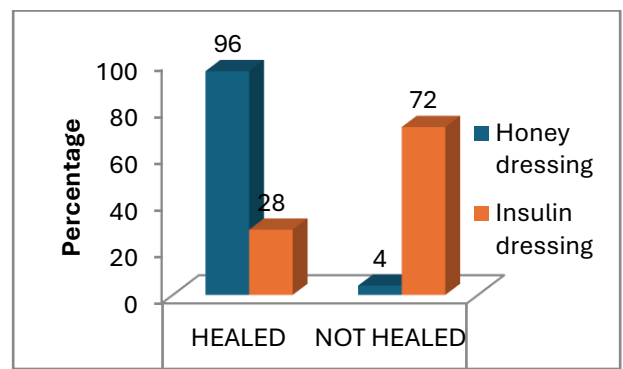


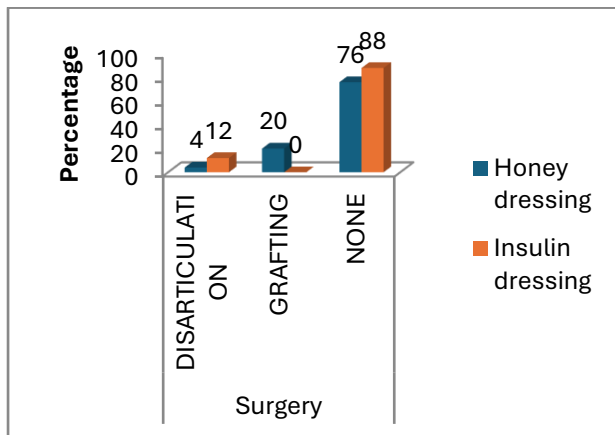
Fig 8: HEALED VS NOT HEALED IN BOTH GROUPS



Except for 1 patient (4%) in the honey dressing group, all patients' wounds healed during the 90 duration of the study, while in the insulin dressing group, only 7 patients (28%) had healed, and 18 patients (72%) had wounds that did not heal during the study duration.



Fig 9: INTERVENTION DONE



STATISTICAL ANALYSIS

TABLE 4: DIFFERENT PARAMETERS OF WOUND HEALING

P-value on considering

	chi-square/Fisher's exact test p	
AGE	0.134	NS
SEX	0.333	NS
SURGICAL INTERVENTION	0.101	NS
ORGANISM GROWN	0.747	NS
TYPE OF ORGANISM GROWN	0.159	NS
ANTIBIOTIC SENSITIVITY	0.480	NS
NATURE OF WOUND	0.758	NS
RETINOPATHIC CHANGES	0.083	NS
NEPHROPATHIC CHANGES	0.529	NS
WAGNER GRADING	0.475	NS
OUTCOME	0.000	HS

DAYS	0.465	NS
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Wound healing of both groups, evaluating the parameters mentioned above, was found to be insignificant.

TABLE 5: INTERVENTION DONE

	group		Total
	Group 1	Group 2	
Surgery DISARTICULATION	1 4.0%	3 12.0%	4 8.0%
GRAFTING	5 20.0%	0 .0%	5 10.0%
NONE	19 76.0%	22 88.0%	41 82.0%
Total	25 100.0%	25 100.0%	50 100.0%

Fishers exact test p= .017, sig

Only 1 patient (4%) from Group A underwent disarticulation, while 3 patients (12%) from Group B underwent disarticulation. 5 patients (20%) from Group A underwent skin grafting, while none from Group B underwent skin grafting. 19 patients (76.0%) from Group A and 22 patients (88%) from Group B did not undergo any intervention during the study period.

5. DISCUSSION

At the end of the study, it was found that the patients who were in group A (honey dressing) had healed faster. It was also noted that, except for one patient in group A, all patients' wounds had healed during our study duration (90 days), while in group B (insulin dressing) only 7 patients' wounds had healed during the study duration.

Our study also showed that even after taking into consideration other parameters like age, sex, organism growth, antibiotic sensitivity, acute or chronic wound, and statistically analysing, it was found that wounds in both groups were independent of the above parameters.

In our study, it was seen that both groups' wound healing was the same till day 7, while in group A (honey dressing), the wound surface was reducing faster than in group B (insulin dressing). Statistical analysis showed that wound healing was much faster in group A, and also the need for disarticulation was less in Group A compared to group B.

Honey is one of the oldest foods and is an ancient remedy for wound healing. Properties of honey



which help to prevent the invasion of bacteria are high sugar and low moisture level, gluconic acid, which produces an acidic environment and hydrogen peroxide. It's also documented that there is a reduction of amputations in diabetic patients by honey dressing²⁷. Even before the discovery of bacteria as a cause of infection, honey was used to manage infected wounds. In the 50th century AD, honey was "good for all rotten and hollow ulcers" by Dioscorides²⁸. Honey has also been seen to have inhibitory effects against many bacterial species, aerobes and anaerobes, gram-positive and gram-negative and antifungal effects against some fungi such as *Aspergillus*, *Penicillium*²⁹ and dermatophytes^{30,31}. Re-evaluation is going on for wound management with honey due to increased antibiotic resistance. Dunford and Hanano studied the effect of honey dressing in patients with chronic wounds, and amongst the 40 patients enrolled in their study, use of honey led to reduction of pain in 20 (50%) patients, 20 out of 21 patients had reduction in odour³². Due to the natural glucose oxidase enzyme introduced into the honey by the bee, which, when it encounters moisture of the body, releases sufficient levels of hydrogen peroxide in the wound against bacterial growth, which helps in wound healing^(33, 34).

After the discovery of Insulin in 1921 by Banting, various uses and benefits of insulin have been published, and it was first used by French workers for dressing in 1926^{35,36}. In the early 20th century, Insulin was used for non-diabetic purposes, like insulin injections in rats for improving healing of bone, in horses for healing in the distal limb, and in mice with skin ulcerations³⁷. Leyton in 1938 noticed that there was an increase in healing and epithelisation of wounds with an Insulin dressing. Insulin has been used since 1960 to treat diabetic wounds in humans, and in recent years, insulin as a spray has been used to treat diabetic ulcers, burns with good efficacy³⁹. The mechanism of action by which insulin acts has not been understood, but it acts by decreasing the surface level of sugar and stimulates epithelisation and thus decreases the time taken for healing of wounds⁴⁰.

Individual studies have shown very good healing rates on wounds compared to conventional treatment. Both Insulin and Honey have a lot of healing properties due to the nature of the contents they have. In our study, we tried to compare the healing process

between the two methods of dressings. After the initial debridement, both insulin and honey dressings were applied to the wounds. There was a significantly better healing with honey dressing in terms of reduced duration of hospital stay, rapid desloughing rate, and microbial. When the duration of hospital stays, number of debridements and dressings were audited for cost, honey dressing was preferable.

There was no mortality in our series. All diabetics received insulin for control of blood sugar. The application of either Insulin or honey dressing does not affect the glycemic status during our study. The application of Honey or insulin did not cause a significant increase in pain when both groups were compared. At the end of the study, the Honey dressing was found to be better in wound healing compared to the Insulin dressing in Wounds.

6. CONCLUSION

Honey dressing, as compared to Insulin dressing, is very effective in wound healing with rapid slough and microbial clearance. The making, storage and application are simple with cost effectiveness and gratifying results. With the increasing prevalence of antibiotic resistance, the duration of hospital stays and the expenditure for wound care have been continuously increasing. This calls for a more economical and effective mode of wound management. In this study, we compared honey dressing and insulin dressing on diabetic foot ulcers. This was studied over a period of two years and involved 50 patients who were divided into two groups. Individual patients were monitored over a period of 90 days for a decrease in surface area/total wound healing, whichever occurred first. This study concluded that natural honey is easily available, more effective and economical in managing diabetic wounds.

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The authors declare no conflict of interest.

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