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Evaluating the Effectiveness of Honey and Standard Dressings on Wound Healing in Open Tibia Fractures: A Randomized Controlled Trial

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Abstract

Wound healing in open fractures presents significant challenges, especially in low-resource settings, due to high rates of complications. Honey, known for its antimicrobial and healing properties, offers a potential alternative. This randomized controlled trial evaluates the effectiveness of honey dressings compared to standard dressings in wound healing for open tibia fractures. This open-label randomized comparative trial was conducted at the University Teaching Hospital of Kigali, Rwanda, involving 100 adult patients with Gustilo IIIA open tibia fractures of whom 98 patients were analysed. Participants were randomly assigned to either the intervention group receiving honey dressings or the control group receiving standard saline dressings. Primary outcomes included wound healing rate at 30 days, with secondary outcomes assessing wound size, pain, odour, exudate, and cleanliness. Data analysis was performed using logistic regression, chi-square tests, and Bayesian methods. The honey dressing group demonstrated significantly improved outcomes, including faster wound healing, reduced pain, decreased wound odour, and a greater reduction in wound surface area by day 30 compared to the control group. Logistic regression revealed a 10.87-fold increased likelihood of complete healing within 30 days for the honey group ($p< 0.05$). The type of dressing used significantly influenced wound healing, outperforming other factors like bone coverage, previous limb injury, and residence. Honey dressings significantly enhance wound healing in open tibia fractures compared to standard dressings, suggesting their potential as an effective adjunct in fracture management, particularly in resource-limited settings. Further research is recommended to refine optimal honey application methods and concentrations.

Keywords: *Honey Dressings, Open Tibia Fractures, Randomized Controlled Trial, Wound Healing.*

Background

Wound healing in open tibia fractures presents a significant clinical challenge, especially in resource-limited settings like Rwanda [1]. These fractures are often associated with high rates of complications, including infections (up to 30% of cases), delayed healing, and non-union, which can lead to prolonged hospital stays and increased healthcare costs [2]. The effectiveness of wound management strategies is critical in improving patient outcomes, and various methods have been explored over the years [3]. Among these, the use of honey as a topical treatment has garnered attention due to its

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natural antimicrobial properties and its ability to promote wound healing [4].

Honey has been used in traditional medicine for centuries, and its potential benefits in modern clinical practice have been increasingly recognized [5]. Studies have demonstrated that honey can accelerate wound healing by creating a moist wound environment, reducing inflammation, and promoting tissue regeneration [6]. Moreover, honey's broad-spectrum antimicrobial activity, including its effectiveness against antibiotic-resistant bacteria, makes it a promising option for managing infected wounds [7]. These properties are particularly valuable in the treatment of open tibia fractures, where infection control is paramount.

Standard wound dressings, such as gauze and hydrocolloids, have been the mainstay of wound management in orthopaedic trauma care. These dressings aim to protect the wound, absorb exudate, and maintain a moist environment conducive to healing [8, 9]. Standard dressings for open fractures have mixed outcomes, with studies showing suboptimal healing times and higher infection rates compared to advanced methods. For severe fractures, standard dressings had a deep infection rate of 8.1% and did not significantly improve healing rates or quality of life at 12 months [9]. The variability in outcomes has led to an ongoing search for alternative or adjunctive treatments that can enhance wound healing and reduce the risk of complications.

In recent years, there has been growing interest in comparing the effectiveness of honey-based dressings to standard treatments in various types of wounds, including burns, ulcers, and surgical wounds. Several randomized controlled trials (RCTs) have suggested that honey may offer superior healing outcomes compared to conventional dressings [10]. However, evidence specific to its use in open fractures, particularly in low-resource settings, remains limited. This gap in the literature highlights the need for more focused research on the potential benefits of honey in orthopaedic trauma care [4]. This randomized controlled trial aims to evaluate whether honey can offer a viable alternative to standard dressings in promoting wound healing and reducing complications in open tibia fractures at Kigali Teaching University Hospital (CHUK).

Methods

Study Design and Setting

This open-label, randomized trial was conducted at the Orthopaedic Unit of the University Teaching Hospital of Kigali (CHUK), a leading Rwandan healthcare facility serving over six million people. The unit is equipped with advanced trauma and orthopaedic care infrastructure, including an in-theatre image intensifier, and is staffed exclusively by trained orthopaedic surgeons. Collaborative support from specialities such as plastic surgery is available for complex soft tissue management.

Population and Sampling

This randomized controlled trial evaluated the effectiveness of honey and standard dressings on wound healing in open tibia fractures. The study included patients with Gustilo IIIA open fractures of long bones who were admitted to the Orthopaedic and Trauma wards at the University Teaching Hospital of Kigali (CHUK) between August 2022 and June 2023. Eligible participants were adults aged 18 years or older with non-infected open fractures at the time of admission. Exclusion criteria encompassed patients unable to provide consent, those with already infected open tibia fractures, ongoing steroid therapy or chemotherapy, a history of keloid formation, substance abuse, heavy smoking (more than 20 cigarettes per day), or poorly controlled blood glucose levels in diabetics. Additional

exclusions included patients who were comatose or had mental disabilities.

Randomisation

Participants were randomly assigned to either the control group, which received standard saline dressings, or the intervention group, which received honey dressings made with Uburanga honey from Rwanda. The wound care protocol involved cleansing the wound with saline, applying the respective dressing (saline or honey), and covering it with sterile gauze. Randomization was achieved using a computer-generated sequence managed by an independent researcher to ensure allocation concealment. Opaque, sealed envelopes prepared by an independent statistician were used, and these were opened only after participant enrolment to prevent selection bias.

Sample Size Calculation

The sample size was determined using a formula for comparing two independent proportions, based on previous research indicating a 90% fracture union rate in the intervention group and 60% in the control group. [11]. With an alpha of 0.05 and a power of 80%, 46 participants per group were required. To account for potential dropouts, the sample size was adjusted to 100 participants, with 50 assigned to the honey treatment group and 50 to the control group. Data collection was conducted using a pretested, pre-designed proforma.

Interventions and Procedure

Participants in this study were randomly assigned to one of two groups: the control group, which received standard saline dressings, and the intervention group, which received honey dressings made with Uburanga honey sourced from Rwanda's Akagera Park Forest. The honey was prepared in sterile 50 mg flacons, certified by the Rwanda Standard Board, and stored at ambient temperature in the hospital pharmacy to ensure quality. The wound care regimen was standardized for both groups. Wounds were cleansed using sterile water, followed by the application of the assigned dressing (saline or honey) and covered with sterile gauze. Dressings were changed every two days, starting on the first postoperative day, and continued until wound healing was confirmed.

The primary outcome measured was the rate of wound healing 30 days post-operation, assessed through clinical examination. Secondary outcomes included evaluations of wound size, presence of infection, pain intensity, itchiness, odor, exudate levels, and overall wound cleanliness. Additionally, all participants received postoperative antibiotics (Ceftriaxone and Gentamycin), initiated in the emergency department and continued for 2–7 days based on clinical response. Data collection was performed at designated follow-up intervals using a pretested, pre-designed proforma to ensure consistency and accuracy in clinical assessments.

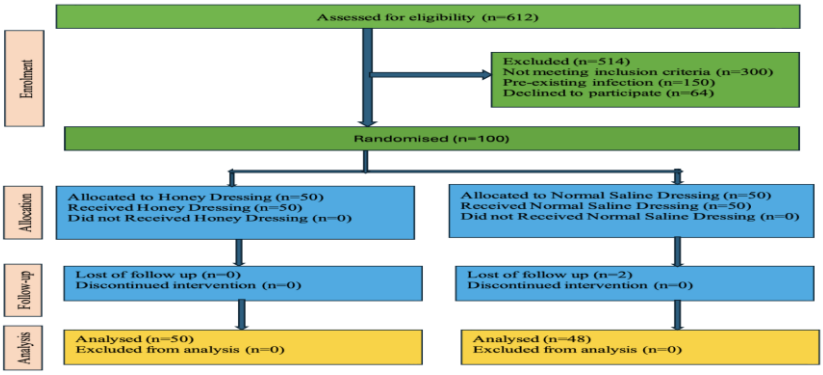

Figure 1. Flowchart

Data Management and Analysis

Data management was conducted using the Kobo Toolbox platform, ensuring adherence to confidentiality and data protection regulations. Data analysis was performed using STATA 23 software. Socioeconomic status was categorized according to the Rwandan government's Ubudehe system, which classifies households into four categories: Category I (impoverished and vulnerable citizens), Category II (those with basic housing but limited food security), Category III (employed individuals or employers), and Category IV (business executives, full-time employees, government workers, and commercial enterprise owners).

Categorical variables were presented as proportions, while continuous variables were summarized using means and standard deviations. Associations between dependent and independent variables were assessed using a logistic regression model. Bayesian methods were employed to enhance the robustness of the analysis, complemented by chi-square tests and Mann-Whitney U tests where appropriate. Statistical significance was defined as a p-value less than 0.05. These methods ensured a rigorous evaluation of the relationships between the study variables and the primary and secondary outcomes.

Ethical Considerations

Ethical approval for the study was granted by the Rwanda National Ethics Committee (Approval No. 34/RNEC/2022) and the University Teaching Hospital of Kigali Joint Institutional Ethics Review Committee (Approval No. EC/CHUK/081/2021). The trial was also registered with the Rwanda Food and Drug Administration (Registration No. 017/CTAC/FDA/2022). Informed consent was obtained from all participants before their enrolment, ensuring that data were kept confidential and used exclusively for research purposes. Participants were informed of their right to withdraw from the study at any time; however, no participants opted to discontinue their involvement.

Results

Demographics

Table 1 shows that the demographic analysis reveals that the control group (N=48) and the intervention group (N=50) are largely comparable across various factors. The average age for participants was 36.37 ± 14.42 years, and there was no significant difference in age distribution (p=0.406). Additionally, no significant differences were found regarding residence (p=0.830), education level (p=0.168), occupation (p=0.437), economic status (p=0.193), or cause of injury (p=0.566). However, a significant difference emerged in sex distribution, with 79.17% of the control group and 94% of the intervention group being male (p=0.03). This suggests that although the groups are mostly comparable, the notable difference in sex distribution warrants careful consideration when interpreting the study's results.

Table1. Demographics

Factors	**Control N:48**		**Intervention N:50**		**Test-Statistics**	
	N	**%**	**N**	**%**	**X^2**	**(p-value)**
Age group Mean:36.37±14.42					1.8022	0.406
18-30	18	37.50	21	42.00		
31-45	17	35.42	21	42.00		

>45	13	27.27.08	8	16.00		
Sex					4.6833	0.30
Female	10	20.83	3	6.00		
Male	38	79.17	47	94.00		
Residence					0.0462	0.830
Rural	22	45.83	24	48.00		
Urban	26	54.17	26	52.00		
Education level					5.050	0.168
None	11	22.92	7	14.00		
Primary	28	58.33	28	56.00		
Secondary	9	18.75	11	22.00		
University	0	0.00	4	8.00		
Occupation					3.7753	0.437
Farmer	23	47.92	20	40.00		
Others	2	4.17	6	12.00		
Private/Business	20	41.67	18	36.00		
Public officers	0	0.00	1	2.00		
Students	3	6.25	5	10.00		
Economic Status					3.2939	0.193
I	3	6.25	9	18.00		
II	26	54.17	22	44.00		
III	19	39.58	19	38.00		
Cause of Injury					3.888	0.566
Road Traffic Injury	31	64.59	33	66.00		
Fall	13	27.08	10	20.00		
Others (mining, physical assault)	4	8.33	7	14.00		

Clinical Factors of The Patients at Admission

The clinical characteristics at admission for the control (N=48) and intervention (N=50) groups were largely similar, with no significant differences in comorbidities (8.34% in both groups, p=0.376), previous injuries to the same limb (12.50% vs. 4.00%, p=0.124), emergency immobilization (97.92% vs. 98.00%, p=0.977), wound washout (91.67% vs. 98.00%, p=0.154), antibiotic use (97.97% vs. 98.00%, p=0.977), associated injuries (14.58% vs. 10.00%, p=0.489), side of injury (p=0.156), or timing of initial antibiotic administration (p=0.294). However, the type of fracture differed significantly, with more comminuted fractures in the control group (66.67%) and more simple fractures in the intervention group (54.00%) (p=0.039). This variation in fracture type is a crucial clinical factor in the study (Table 2).

Table 2. Clinical Factors of the Patients at Admission

Factors	**Control (N:48)**		**Intervention(N:50)**		**Test-Statistics**	
	N	**%**	**N**	**%**	**X^2**	**(p-value)**
Comorbidities (HIV, DM, Hepatitis)					5.3392	0.376

Yes	4	8.34	4	8.34		
Non	44	91.67	46	92.00		
Previous same limb injury					2.3602	0.124
No	42	87.50	48	96.00		
Yes	6	12.50	2	4.00		
Immobilisation at the emergency					0.009	0.977
No	1	2.08	1	2.00		
Yes	47	97.92	49	98.00		
Wound wash out at the emergency.					2.0288	0.154
No	4	8.33	1	2.00		
Yes	44	91.67	49	98.00		
Tetanus prevention						
No	8	16.67	2	4.00		
Yes	40	83.33	48	96		
Antibiotics at the emergency					0.0009	0.977
No	1	2.08	1	2.00		
Yes	47	97.97	49	98.00		
Time of the 1st ATB from arrival					1.1025	0.294
>6Hours	18	37.50	24	48.00		
≤6Hours	30	62.50	26	52.00		
Type of ATB at Emergency					6.4066	0.269
Single ATBs	19	39.58	22	44.00		
Combined ATBs (	29	60.42	27	54.00		
None	0	0.00	1	2.00		
Associated injury					0.4788	0.489
Head injury	7	14.58	5	10.00		
None	41	85.42	45	90.00		
Side of injury					3.7126	0.156
Bilateral	3	6.25	1	2.00		
Left	22	45.83	32	64.00		
Right	23	47.92	17	34.00		
Site of injury						
Lower 1/3	23	47.92	23	46.00		
Middle 1/3	20	41.67	22	44.00		
Upper 1/3	5	10.42		10.00		
Type of the fracture					4.2476	0.039
Community	32	66.67	23	46.00		
Simple	16	33.33	27	54.00		

*Single: Cefazolin, Cefotaxime, Ceftriaxone.

* Combined ATBs: Cefotaxime & Gentamycin, Ceftriaxone & Gentamycin.

Perioperative Information of the Patients in Both Groups

Table 3 highlights significant differences between the control and intervention groups in terms of the type of anaesthesia used (p =

0.037) and bone coverage (p = 0.031). The intervention group exclusively received spinal anaesthesia and demonstrated a higher occurrence of uncovered bone following surgery. However, no statistically significant differences were found between the groups concerning other perioperative factors, such as the surgical procedure, antibiotic prophylaxis, irrigation volume, estimated blood loss, intraoperative transfusions, and postoperative antibiotic usage.

Table3. Perioperative Information of the Patients in Both Groups

Factors	**Control N:48**		**Intervention N:50**		**Test-**	
	N	**%**	**N**	**%**	**X^2**	**(p-value)**
Type of anaesthesia					4.3440	0.037
GA	4	8.33	0	0.00		
SA	44	91.67	50	100.00		
Types of procedure					1.7423	0.418
Splint	5	10.42	4	8.00		
External fixator	33	68.75	40	80.00		
Internal fixator (IMN)						
ATBs Prophylaxis					3.0716	0.381
Cefazolin	4	8.33	5	10.00		
Cefotaxime	2	4.17	0	0.00		
Ceftriaxone	39	81.25	39	78.00		
Other	3	6.25	6	12.00		
Irrigation (L of NS)					0.6933	0.405
<9	41	89.13	46	93.88		
≥9	5	10.87	3	6.12		
Estimated blood loss					1.5203	0.218
≤ 100	43	89.58	48	96.00		
≥100	5	10.42	2	4.00		
Bone Coverage					4.6389	0.031
Primary closure	47	97.92	43	86.00		
Not covered	1	2.08	7	14.00		
Per operative transfusion					0.0816	0.775
No	44	91.67	45	90.00		
Yes	4	8.333	5	10.00		
Post-op ATBs					10.10	0.183
Single ATBs	4	14.58	6	12.00		
Combined ATBs	44	83.14	33	66.00		
None	0	0.00	1	2.00		

*Single ATBs: Cefazolin, Ceftriaxone

*Combined ATBs: Cefazolin &Gentamycin, Cefotaxime & Gentamycin

Discharge Information in Both Groups.

Honey dressings reduced hospitalization time, with 86% released after seven days compared to 58.33% for conventional dressings

(p=0.002), with an overall mean hospital stay of 9.46 days. Honey dressing also reduced discharge problems, including surgical site infections (14% vs. 31.25%; p= 0.041). The honey dressing group had a greater wound healing rate by day 30 (86% vs. 37.5%; p = 0.000). These data indicate that honey dressings are more effective than normal dressings for open tibia fracture wound healing (Table 4).

Table 4. Discharge Information

Factors	**Control (N:48)**		**Honey dressing (N:50)**		**Test-**	
	N	**%**	**N**	**%**	**X^2**	**(p-value)**
LOH ($\bar{X}$= 9.469±8.90, Min=5, Max=33)					9.39	0.002
≤7	28	58.33	43	86.00		
≥7	20	41.67	7	14.00		
Complications at Discharge					4.18	0.041
SSI	15	31.25	7	14.00		
None	33	68.75	43	86.00		
Wound healing D30					24.51	p<0.01
No	30	62.50	7	14.00		
Yes	18	37.50	43	86.00		

Wound Healing Rates at Day 30 by Dressing Type

Figure 2 demonstrates the wound healing rates at Day 30 for patients treated with honey dressings (intervention) and standard dressings (control). The honey dressing group achieved a significantly higher wound healing rate of approximately 86%, compared to 38% in the standard dressing group. This difference is statistically significant, as indicated by the p-value of 7.2989e-06, suggesting a robust association between the type of dressing used and wound healing outcomes. The results underscore the superior efficacy of honey dressings in accelerating wound healing, providing convincing evidence to recommend honey as an effective alternative to standard treatments.

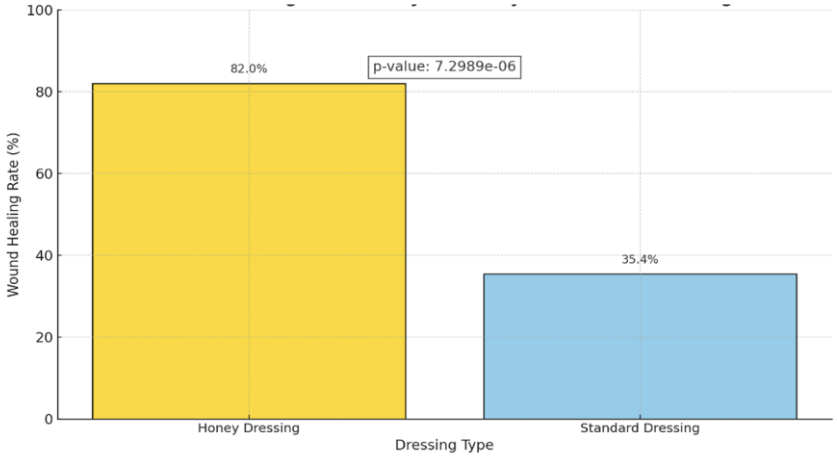

Figure 2. Wound Healing Rates at Day 30 by Dressing Type

Wound Assessment Factors at Day 5 in both groups

Figure 3 shows that Honey Dressing outperforms Standard Dressing across all wound assessment factors on Day 5. Honey Dressing significantly reduces pain (95% vs. 70%), itchiness (75% vs. 60%), and odour (98% vs. 83%), while managing exudate better (80% vs. 50%) and maintaining higher cleanliness (95% vs. 90%). It also shows superior improvement in wound surface (98% vs. 73%) and depth (84% vs. 37%). These results suggest that Honey Dressing is more effective in promoting wound healing and managing associated symptoms.

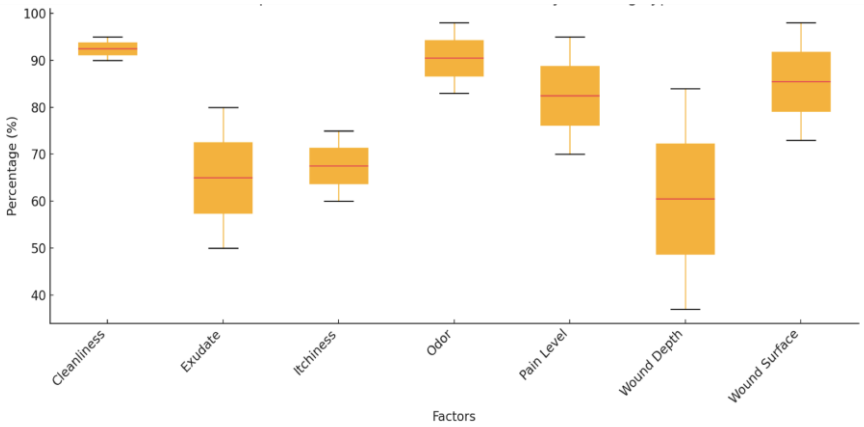

Figure 3. Boxplot Wound Assessment Factors at Day 5 in Both Groups.

Wound assessment in both groups at 30 days post-operative

Table 5 shows that honey dressing outperformed conventional dressings in open tibia fracture wound healing across various criteria. By day 30, 86% of honey patients had full wound healing compared to 37.50% of controls ($p<0.01$). The honey group had 100% little discomfort, while 29.17% of the control group had considerable pain ($p<0.01$). The honey group had 70% no irritation compared to 45.83% in the control group, and moderate itchiness was 4% vs. 31.25%, $p<0.01$. Additionally, 98% of honey group patients had no wound odour, compared to 83.33% of control group patients ($p=0.032$). A wound surface area decreases of ≤25% was achieved in 98% of the honey group compared to 72.92% in the control group ($p<0.01$). Honey also improved wound outcomes, with 92.86% of wounds in the honey group having no exudate compared to 87.50% in the control group ($p=0.125$). These results show that honey dressings accelerate and complete wound healing in open tibia fractures better than conventional dressings.

Table 5. Wound Assessment at 30 Days Post Operative in Both Groups

Factors	**Control (Standard dressing) N:48**		**Honey dressing N:50**		**Test- Statistics**	
	N	**%**	**N**	**%**	**X^2**	**(p-value)**
Pain level					17.01	0.000
Minor	34	70.83	50	100.00		
Moderate	14	29.17	0	0.00		
Itchiness					13.03	0.001
None	22	45.83	35	70.00		

Mild	11	22.92	13	26.00		
Moderate	15	31.25	2	4.00		
Odor					6.87	0.032
None	40	83.33	49	98.00		
Slight	5	10.42	0	0.00		
Moderate	3	6.25	1	2.00		
Exudate					4.16	0.125
None	42	87.50	49	98.00		
Sanguineous	1	2.08	0	0.00		
Serous	5	10.42	1	2.00		
Cleanliness					1.05	0.59
Clean	46	95.83	49	98.00		
Clean-contaminated	1	2.08	1	2.08		
Dirty or infected	1	2.08	0	0.00		
Wound |surface					12.58	p<0.01
≤25	35	72.92	49	98.00		
≥25	13	27.08	1	2.00		
Wound depth					22.73	p<0.01
Deep (exposed bone)	4	8.33	2	4.00		
Full (covered by muscles	26	54.17	6	12.00		
Healed	18	37.50	42	84.00		
Wound healing					24.51	p<0.01
No	30	62.50	7	14.00		
Yes	18	37.50	43	86.00		

Comparison of Key Outcomes Between Honey and Standard Dressing Groups

The honey dressing group achieved significantly better outcomes than the standard dressing group: 98% had a wound surface reduction of ≤25% vs. 73% (p<0.01), and 100% reported minor pain vs. 71% (p<0.01). Hospital stays ≤7 days were observed in 86% of the honey group compared to 58% for standard dressings (p=0.002). Discharge complications were lower with honey dressings, with 86% having no complications vs. 69% (p=0.041). Overall, honey dressings significantly improved wound healing and patient recovery metrics (Figure 4).

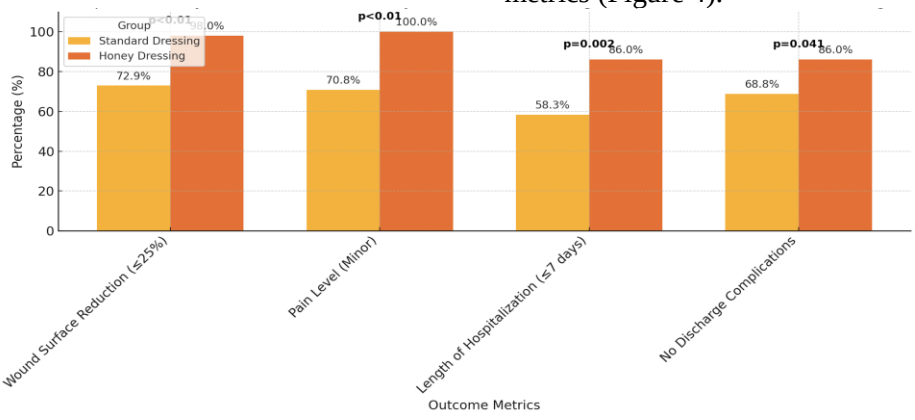

Figure 4. Comparison of Key Outcomes Between Honey and Standard Dressing Groups

Comparison of wound healing factors: Honey vs standard dressing at day 5 and day 30 post-operative

Figure 5 reveals that honey dressings outperform standard dressings significantly in a variety of wound-healing features. Regarding wound parameters, both dressing types were initially similar, with no significant differences by day 5 in pain ($p = 0.348$), itchiness ($p = 0.130$), odour ($p = 0.329$), exudate ($p = 0.689$), and cleanliness ($p = 0.287$). However, the honey dressing group displayed markedly improved wound closure and outcome by 30 days post-operative, as confirmed by the following findings: all wounds with only minor pain in the honey group ($p<0.01$), 70% with no itching ($p = 0.001$), 98% with no odour ($p = 0.032$), and 98% with no exudate. On the 30-day post-operative wound surface area, 98% in the honey group had a wound surface area of 25% or less ($p<0.01$) compared to 4% in the standard dressing group. There were missing data points in both groups; hence, only 86% of those with honey dressing had no deep wound compared to 20% in the standard dressing exposure group ($p<0.01$). Notably, complete wound healing was achieved by 86% on day 30 in patients with honey dressing compared to 37.50% in those exposed to standard dressing ($p<0.01$). These results are significant and demonstrate that honey dressings outperform standard dressings in extensive wound closure and at early stages due to quicker and more complete wound healing.

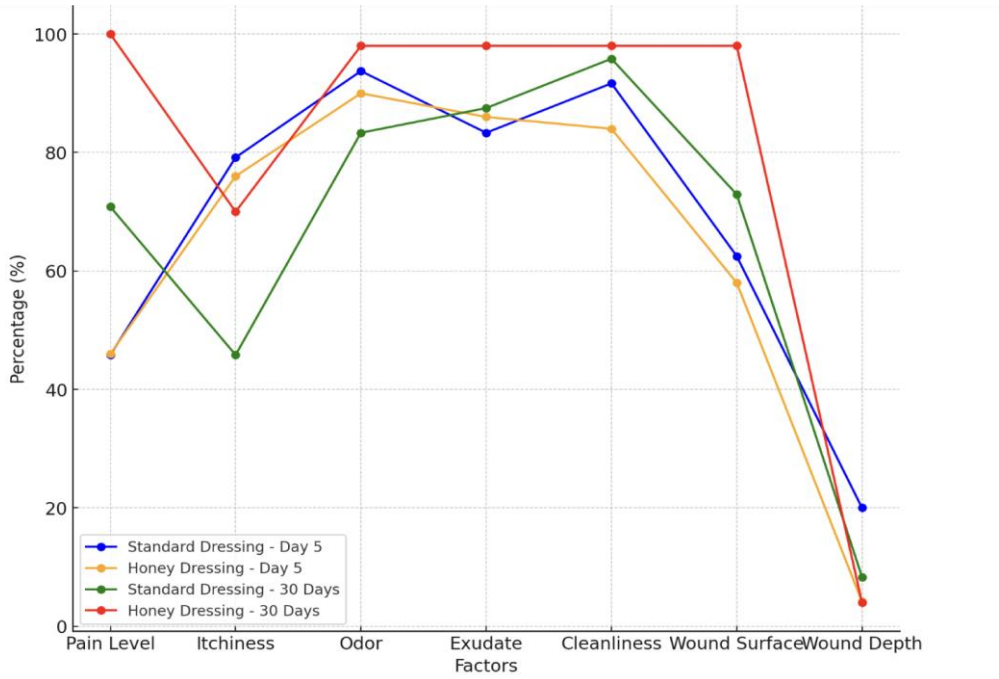

Figure 5. Comparison of Wound Healing Factors: Honey vs Standard Dressing at D5 and D30 post-operative

The logistic regression analysis of honey dressing versus standard dressing on wound healing

Figure 6 is about the logistic regression analysis demonstrated that the type of dressing, honey dressing versus standard dressing, had a significant impact on the probability of wound healing at 30 days. Patients treated with honey dressing (as determined by the randomization variable) were about 10.87 times more likely to achieve wound healing compared to those who received standard dressing, with a 95% confidence interval of 3.06-38.64. This result was statistically significant, with a p-value of 0.0002, highlighting a strong link between honey dressing and better wound healing

outcomes. While other factors in the model, such as bone coverage, previous limb injury, and place of residence, had some effect on wound healing, none were as statistically significant as the type of dressing used.

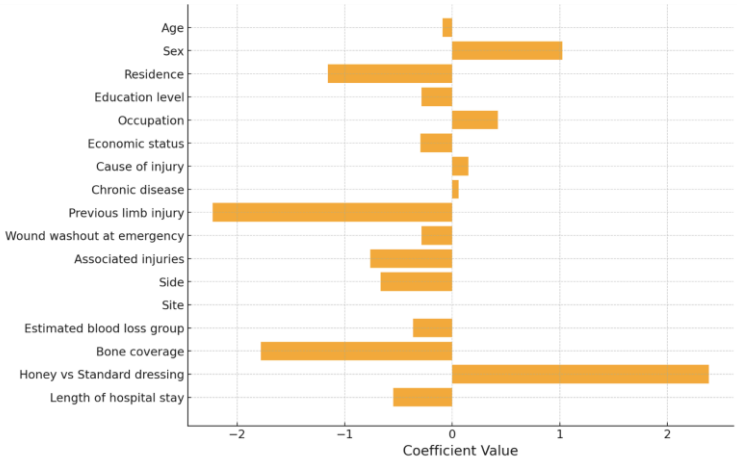

Figure 6. The Logistic Regression Analysis Honey Dressing Versus Standard Dressing on Wound Healing

Discussion

Honey dressings outperform regular dressings in wound healing, according to the study "Evaluating the effectiveness of honey and standard dressings on wound healing in open tibia fractures: A randomized controlled trial".

Demographically and socioeconomically, the two groups were similar. Despite not being statistically significant, the control group contained more participants over 45. Much wound care research emphasizes demographic matching. Age is critical to wound healing because comorbidities and reduced cellular activity impede wound healing in elderly people [12]. Both groups had primarily male members, showing that open tibia fractures are most common in rural, low-income areas with high-risk jobs [13]. The study's comparability is improved by the non-significant gender distribution disparity. The study found no significant differences in rural versus urban residence status, suggesting equal distribution of environmental factors like healthcare access. Similar education levels and occupational status, mostly farmers or private/business workers, also contributed to the findings, highlighting the importance of wound care in diverse settings. Manual labourers are more likely to get complicated, polluted wounds, which can lead to infection [14].

The study's results align with existing literature that highlights the efficacy of honey in promoting wound healing. Honey has been demonstrated to reduce bacterial colonization, enhance tissue regeneration, and decrease inflammation, contributing to faster wound healing [15, 16].In this trial, the honey dressing group exhibited significantly better outcomes across multiple parameters, including a higher rate of complete wound healing by day 30, reduced pain reporting little discomfort in the honey group in the control group, less itching, and fewer instances of wound odour. These findings are consistent with previous studies, which found that honey dressings improved wound healing in partial thickness burns and infected postoperative wounds [4, 17]. The current study extends these findings to open tibia fractures, a more complex and severe wound type, underscoring the broader applicability of honey as a potent wound care agent.

The logistic regression analysis in this research reinforces the efficacy of honey

dressings, indicating that patients receiving honey treatment were 10.87 times more likely to attain wound healing after 30 days compared to those using conventional dressings. This finding emphasizes the significant and independent role of honey dressings in promoting wound healing, supporting previous research that has pointed to honey's unique properties, such as its osmotic effect, low pH, and hydrogen peroxide content, all of which contribute to its antibacterial and healing-promoting effects [18–20].

Our study provides robust evidence that honey dressings significantly enhance wound healing outcomes in patients with open tibia fractures compared to standard dressings. These results are in line with existing literature that supports the use of honey in various wound types, suggesting that honey could be a valuable addition to wound care protocols, particularly in cases where rapid and complete wound healing is critical [21, 22].

This study highlights that honey dressings significantly improve wound healing in open tibia fractures compared to standard dressings, with faster healing, reduced pain, and less wound odour. Limitations include a small sample size and lack of long-term follow-up, which affect the generalizability of the findings. However, the results add valuable evidence supporting honey's efficacy in wound management, especially in low-resource settings.

Conclusion

This randomized controlled research indicates that honey dressings significantly enhance wound healing in open tibia fractures relative to conventional dressings. The honey dressing group had enhanced results, including expedited wound healing, less discomfort, reduced wound odour, and a more significant decrease in wound surface area by Day 30, with a 10.87-fold increased probability of full healing within 30 days. These results corroborate prior studies on honey's antibacterial and healing capabilities, indicating that honey dressings should be regarded as a valuable adjuvant in the management of open tibia fractures. Healthcare professionals are urged to include honey dressings in treatment methods, and more study should enhance their effective use.

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Data availability statement

Data supporting the study findings are available on request from the corresponding author [JAI]. The data are not publicly available due to ethical data transfer restrictions of IRB that could compromise the privacy of research participants.

Disclaimer

The views and opinions expressed in the submitted article are the author's own and not the official position of the affiliated institutions.

Competing Interest Statements

The authors have declared that there is no competing interest exists.

Contributions

JA, FN, AU, CLU, EM, CU, JN, BM, CB, TN, AI, IN, ENM, GB, CMM participated in all stages of this paper, from the study design, method, grant writing, data collection, analysis and paper writing.

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