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Randomised controlled trial comparing the effect of honey versus standard dressing on fracture union and functional outcomes in open tibia fractures

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Abstract

Objective: Open tibia fractures pose a high risk of infection and delayed healing, necessitating innovative wound management strategies. This randomised controlled trial evaluated the efficacy of honey dressings compared to standard saline dressings in promoting fracture union, reducing infection rates, and enhancing functional recovery in patients with Gustilo IIIA open tibia fractures.

Methods: Conducted at the University Teaching Hospital of Kigali, Rwanda, this open-label, randomised trial enrolled 98 patients with Gustilo IIIA fractures from August 2022 to June 2023. Participants were randomised into two groups: an intervention group receiving honey dressings and a control group receiving saline dressings. Dressings were applied every two days, and all patients received standard antibiotic prophylaxis and fracture management. The primary outcome was fracture union six months post-surgery, evaluated via clinical and radiological assessments. Secondary outcomes included functional recovery, measured by the Lower Extremity Functional Scale, wound healing rates at 30 days, and infection rates.

Results: Of the 98 participants (mean age: 36.4 ± 14.4 years; 87.8% male), honey dressings significantly improved wound healing rates by day 30 (86.0% vs. 37.5%, $p < 0.001$) and reduced surgical site infections (14.0% vs. 31.3%, $p = 0.041$). At six months, fracture union was achieved in 96.0% of the honey group compared to 81.3% of the control group ($p = 0.046$). Functional recovery was superior in the honey group, with 14.0% achieving full function and 60.0% achieving partial function, compared to 4.2% and 35.4%, respectively, in the control group ($p = 0.002$).

Conclusions: Honey dressings significantly enhanced wound healing, reduced infection rates, and improved long-term functional recovery and fracture union. These findings support honey dressings as a cost-effective alternative for managing complex orthopaedic trauma. Future multi-centre trials are warranted to confirm these results and explore the impact of socioeconomic factors on recovery outcomes.

Trial Registration: Rwanda Food and Drug Administration (Registration No. 017/CTAC/FDA/2022).

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Introduction

Open tibia fractures are among the most severe injuries in orthopaedic trauma care and pose significant challenges due to their high risk of infection and delayed healing. These injuries disrupt soft tissues, expose bones to the external environment, and increase the likelihood of complications such as chronic osteomyelitis and repeated surgical interventions[1, 2]. While standard wound dressings protect against contamination and create a moist environment conducive to healing, their role in actively promoting the biological processes necessary for optimal fracture union remains limited[3, 4]. Recent research suggests that honey, with its natural healing properties, may offer a promising alternative[5].

Honey has been used in traditional medicine for its wound-healing capabilities, and recent studies validate its antimicrobial and regenerative properties. Honey contains bioactive compounds such as flavonoids and phenolic acids, which exhibit strong antibacterial activity and can reduce the risk of infection in open fractures[6, 7]. Moreover, honey promotes angiogenesis, the formation of new blood vessels essential for oxygen and nutrient delivery to injured tissues, and modulates inflammation to facilitate bone regeneration[8, 9]. These advantages address key challenges in treating open tibia fractures, where disrupted vascular supply and excessive inflammation often hinder healing[10].

Given the global burden of trauma-related injuries, honey's potential as a wound-care agent is particularly relevant. Open tibia fractures, common in high-energy trauma, highlight the need for therapies that prevent infections without exacerbating antibiotic resistance[11, 12]. While initial studies show honey's potential to reduce infection rates and accelerate healing, further randomized clinical trials are essential to provide robust evidence for its efficacy. This trial at the University Teaching Hospital of Kigali aims to compare the impact of honey and standard dressings on fracture union and functional outcomes in open tibia fractures[13].

Methodology

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 healthcare facility in Rwanda serving over six million people. CHUK is equipped with essential infrastructure for trauma and orthopaedic care, including an in-theatre image intensifier, with care exclusively provided by trained orthopaedic surgeons. Collaborations with specialties like plastic surgery support cases requiring complex soft tissue management.

Inclusion and exclusion criteria

The study comprised patients with Gustilo IIIA open fractures of long bones admitted to the Orthopaedic and Trauma wards at CHUK from August 2022 to June 2023. Participants eligible for the study included adults aged 18 years or older who presented with non-infected open fractures upon admission. The exclusion criteria included patients unable to provide consent, those with already infected open tibia fractures, ongoing steroid therapy, chemotherapy, a history of keloid formation, substance abuse, heavy smoking (more than 20 cigarettes per day), or poorly controlled blood glucose levels in diabetic individuals.

Interventions

Study participants were randomly allocated to one of two groups: the control group, which received standard saline dressings, or the intervention group, which received honey dressings impregnated with Uburanga honey from Rwanda's Akagera Park Forest. This honey was used and kept at ambient temperatures in the hospital pharmacy in sterile 50 mg flacons branded by the Rwanda Standard Board.

The remainder of wound care was standardised between groups. The wound treatment protocol involved irrigating the wound with saline, applying the appropriate dressing (saline-soaked or honey-soaked plain sterile gauze) and securing it bandages. Both groups had their wounds irrigated with saline before the dressing was applied and covered with sterile gauze. Dressings were changed every two days, starting on the first postoperative day, and continued until wound healing was confirmed. In addition, all patients received postoperative antibiotics (Ceftriaxone and Gentamycin), beginning in the emergency department and continuing for 2-7 days based on clinical response. External fixation devices were dynamized at two weeks and removed at approximately four weeks upon confirmation of wound healing, with casting applied thereafter. Rehabilitation began in the sixth week, tailored to each patient's healing progress. Functional outcomes, fracture healing, and other clinical assessments were performed at designated follow-up points to evaluate recovery.

Randomisation

Participants in the 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 from Rwanda. The wound care regimen included cleansing the wound with saline, applying the respective dressing (saline or honey), and covering it with sterile gauze. A computer-generated randomization sequence, managed by an independent researcher, ensured

allocation concealment. The allocation process was secured using opaque, sealed envelopes prepared by an independent statistician, which were only opened after participant enrolment to prevent selection bias. Data were collected using a pretested, pre-designed proforma.

Outcome measures

The primary outcome measure was the rate of fracture union six months after surgery, assessed through clinical examination and X-rays as determined by an orthopaedic surgeon. Fracture union was considered successful when both clinical and radiological evidence of union were present. The study used the Lower Extremity Functional Scale (LEFS) as the key secondary outcome measure to assess functional recovery at 30 days and six months post-surgery. The primary outcome focused on fracture union, while the LEFS provided additional insight into patients' ability to perform daily tasks. Together, the LEFS and primary measures offered a comprehensive evaluation of both structural and functional recovery. Additional secondary outcomes were the assessment of hospital stay duration, wound healing, and the incidence of infection evaluated 30 days post-surgery.

Questionnaires were translated from English to Kinyarwanda and back to English to ensure cultural and linguistic equivalence. The LEFS is a self-reported patient questionnaire containing 20 questions about daily tasks and grading the severity level of impairment and was validated in the Kinyarwanda language[15]. The total score is 80 points for all 20 activities, with a lower score indicating more significant disability. The classification of functionality level is 0%-25%- trace functional, 26%-50%-very poor, 51%-75%-poor, 76%-89%-partial functional, and 90%-100%-fully functional.

Outcome assessment and follow-up

To ensure consistent follow-up, the research nurse coordinated with community health workers, health center staff, and district hospital nurses to oversee regular dressing changes and physiotherapy sessions. Outcome assessors (who may have included orthopaedic surgeons not involved with the initial dressing), radiologists, and statisticians, were blinded to treatment assignments to reduce evaluation bias. Patients, ward nurses, and operating surgeons were un-blinded.

Sample size calculation.

The sample size was calculated before the study using a formula for comparing two independent proportions, based on prior research showing a 90% fracture union rate in the intervention group and 60% in the control group (Deviandri et al., 2018)[12]. With an alpha of 0.05 and 80% power, 46 participants per group were required, adjusted by 5% for potential dropouts, resulting in 98 total participants; we thus aimed to recruit 50 to each group.

Data Management and statistical analysis

Data management was carried out using the Kobo Toolbox platform, ensuring confidentiality and compliance with data protection regulations. Data analysis was conducted using STATA 23 software. Socioeconomic status was classified according to the Rwandan government's Ubudehe system: Category I includes impoverished and vulnerable citizens; Category II includes those with basic housing but limited food security; Category III includes employed individuals or employers; and Category IV comprises business executives, full-time employees, government workers, and owners of commercial enterprises[14]. Categorical variables were expressed as proportions, while continuous variables were summarized as means with standard deviations. A logistic regression model was applied to assess associations between dependent and independent variables. Additionally, the Mann-Whitney U test and chi-square tests were used for analysis, with statistical significance set at a p-value of less than 0.05.

Ethical Considerations

The study received ethical approval from the Rwanda National Ethics Committee (Approval No. 34/RNEC/2022) and the Joint Institutional Ethics Review Committee of the University Teaching Hospital of Kigali (Approval No. EC/CHUK/081/2021). The trial was registered with the Rwanda Food and Drug Administration (Registration No. 017/CTAC/FDA/2022). Informed consent was secured from all participants before their enrolment, guaranteeing that data remained confidential and utilized solely for research purposes. Participants were apprised of their right to withdraw from the study at any moment; nonetheless, no participants chose to terminate their participation.

Results

Demographics

Of 612 patients initially assessed for eligibility, only those with Gustilo IIIA open tibia fractures were included after classification in the operating theatre post-debridement. A total of 512 patients were excluded for having other Gustilo grades, pre-existing infections, significant comorbidities, or lack of consent, leaving 100 patients eligible and enrolled in the trial. Fifty participants were allocated to the intervention group receiving honey treatment, and 50 were assigned to the control group receiving conventional treatment. Two patients were lost to follow-up in the control group. Table 1 shows that the finally analysed patients in the control group (n=48) and intervention group (n=50) were comparable in terms of demographic factors, with no significant differences in age (mean: 36.4 ± 14.4 years, p=0.406), 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, sex distribution differed significantly, with 79.2% of the control group and 94.0% of the intervention group being male (p=0.03). This difference in sex distribution requires consideration when interpreting the study's results.

Clinical Characteristics at Admission

Clinical characteristics of the control and intervention groups at admission were largely similar. No significant differences were observed in comorbidities (8.3% in both groups, p=0.376), previous injuries to the same limb (12.5% vs. 4.0%, p=0.124), emergency immobilization (97.9% vs. 98.0%, p=0.977), wound washout (91.7% vs. 98.0%, p=0.154), antibiotic use (97.9% vs. 98.0%, p=0.977), associated injuries (14.6% vs. 10.0%, p=0.489), side of injury (p=0.156), or timing of initial antibiotic administration (p=0.294). However, fracture type differed significantly, with more comminuted fractures in the control group (66.7%) and more simple fractures in the intervention group (54.0%, p=0.039). This variation in fracture type represents a key clinical consideration in the study (Table 2).

Perioperative Information

Table 3 highlights significant differences in the type of anaesthesia used (p=0.037) and bone coverage (p=0.031). The intervention group exclusively received spinal anaesthesia and had a higher occurrence of uncovered bone following surgery. No statistically significant differences were found between the groups for other perioperative factors, including surgical procedure, antibiotic prophylaxis, irrigation volume, estimated blood loss, intraoperative transfusions, and postoperative antibiotic usage.

Discharge Information

Patients treated with honey dressings had shorter hospital stays, with 86.0% discharged within seven days compared to 58.3% for conventional dressings (p=0.002). The mean hospital stay was 9.5 days overall. The honey dressing group also experienced fewer discharge problems, including lower rates of surgical site infections (14.0% vs. 31.3%, p=0.041) and higher rates of wound healing by day 30 (86.0% vs. 37.5%, p<0.001). These findings suggest that honey dressings are more effective in reducing hospitalization time and promoting wound healing for open tibia fractures (Table 4).

Fracture Union

Table 5 demonstrates that at six months post-treatment, the honey dressing group achieved significantly better outcomes than the control group. While functional recovery differences at 30 days were not significant (p=0.189), by six months, 14.0% of the honey group reached full functional recovery compared to 4.2% in the control group, and 60.0% of the honey group achieved partial function compared to 35.4% of the control group (p=0.002). Additionally, fracture union was significantly higher in the honey group (96.0%) than in the control group (81.3%, p=0.046). These results indicate that honey dressings lead to better long-term functional recovery and fracture union.

Functional Outcomes

Figure 2 highlights the Lower Extremity Functional Scale (LEFS) results, comparing functional outcomes between the control (48 patients) and honey (50 patients) groups. At 30 days, 38.0% of the honey group were classified as "Poor" or "Very poor," compared to 50.0% in the control group, though this difference was not statistically significant (p=0.189). By six months, however, 14.0% of the honey group achieved "Full functional" status and 60.0% were "Partial functional," while no participants remained in the "Very poor" category. In contrast, only 4.2% of the control group achieved "Full functional," and 60.0% remained "Poor" or "Very poor," with a significant difference between groups (p=0.002). These data demonstrate faster and more pronounced functional recovery in the honey group over time.

Figure 3 demonstrates that the improvement index plot and an odds ratio of 4.34 indicate the honey group was significantly more likely to improve from "Poor" or "Very poor" to "Partial functional" or "Full functional" compared to the control group. This is reflected in the honey group's greater shift toward better functional outcomes by six months, with 60.0% achieving "Partial functional" and 14.0% reaching "Full functional," compared to slower improvements in the control group. These findings underscore the honey treatment's superiority in enhancing recovery over time.

Fracture union at Six Months

Multivariate logistic regression analysis (Figure 4) suggests that several factors, including wound healing at day 30, length of hospital stay, intervention, and economic status, influence fracture union at six months. Patients in higher economic groups (Ubudehe III) showed a stronger likelihood of fracture union (odds ratio = 4.5), though this result was not statistically significant (p=0.093). While none of the factors reached statistical significance (p<0.05), trends for intervention and economic status indicate potential areas for further study.

Functional Outcome at Six Months

Comparison of LEFS scores at six months revealed significantly better functional outcomes in the honey treatment group. The Mann-Whitney U test yielded a U statistic of 1586.5 (p=0.006), demonstrating that patients in the honey group achieved higher median LEFS scores than those in the control group, reflecting improved functional recovery (Figure 5).

Factors Influencing Functional Outcomes

Figure 6 indicates that fracture healing at six months had the greatest positive impact on functional outcomes (coefficient = 17.2, p<0.001), while chronic diseases such as diabetes and hypertension were strongly associated with worse recovery (coefficients up to -74.9, p<0.001). Wound healing at day 30, intervention, and emergency wound washout showed smaller, non-significant effects on LEFS scores, suggesting these factors play a lesser role in functional outcomes at six months.

Figure 1: Patient inclusion flowchart

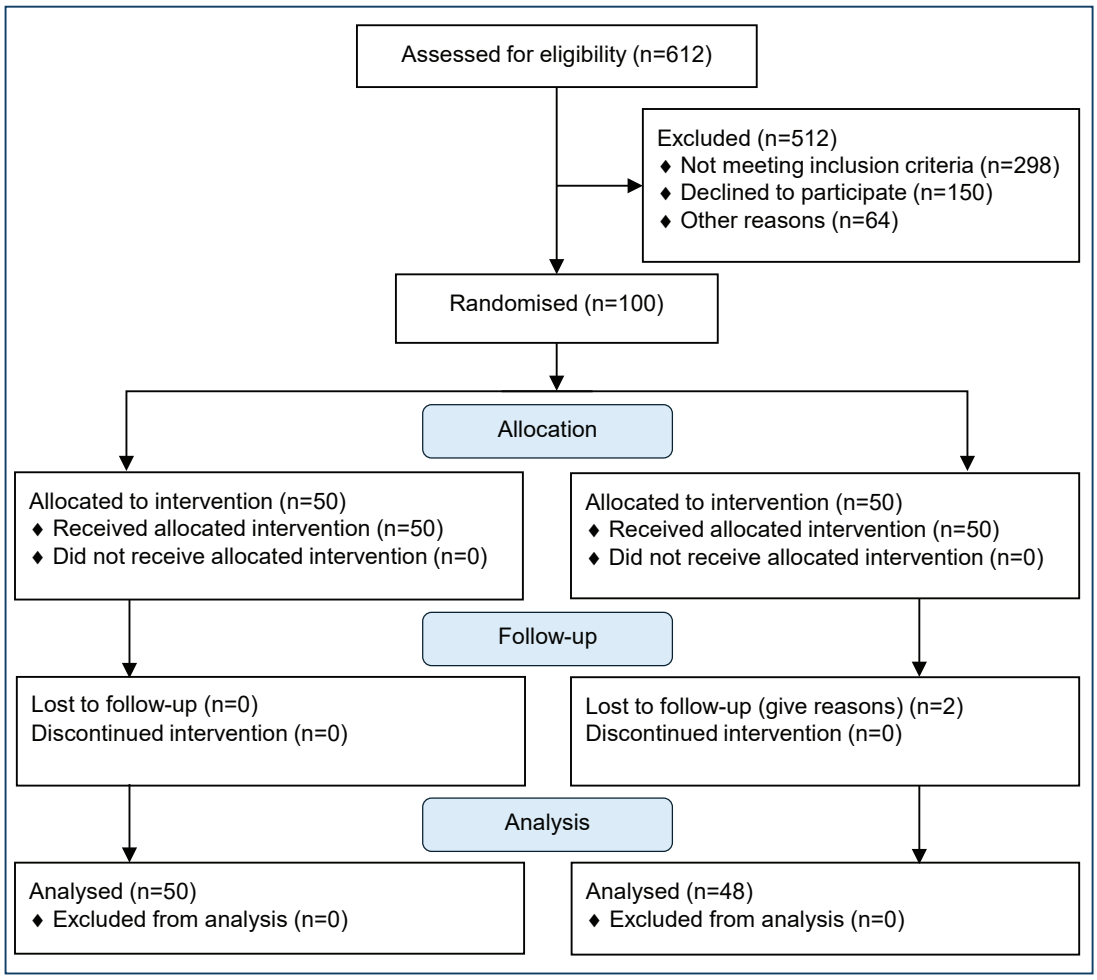

Figure 2: LEFS Comparison at 30 days and 6 months among the two groups

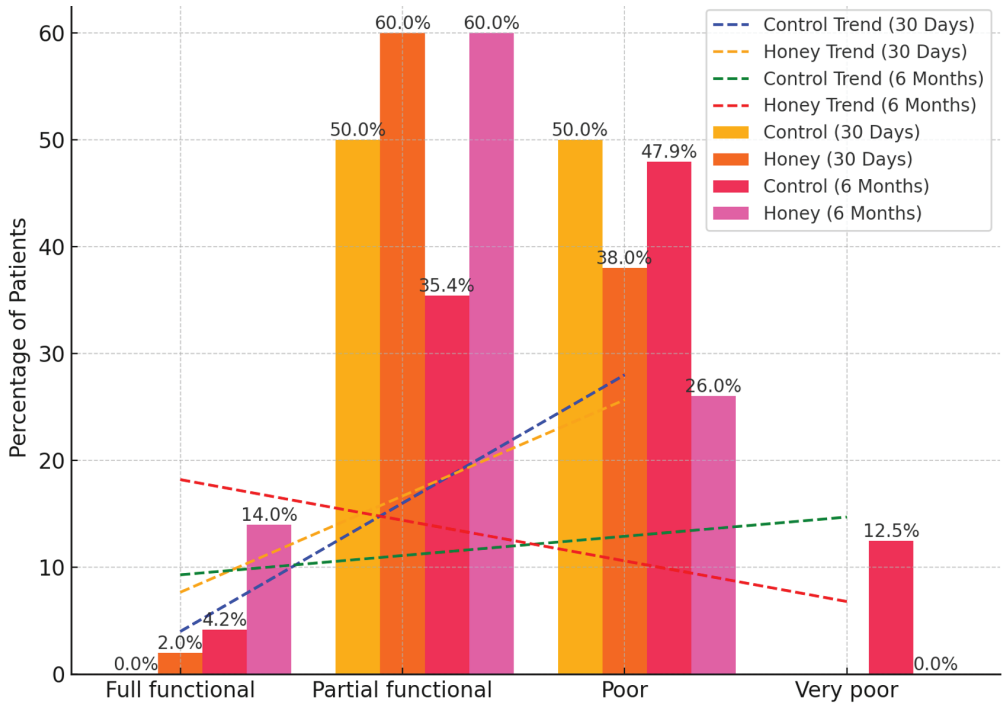

Figure 3: The improvement index plot between the control and the intervention groups at 30 days and 6 months

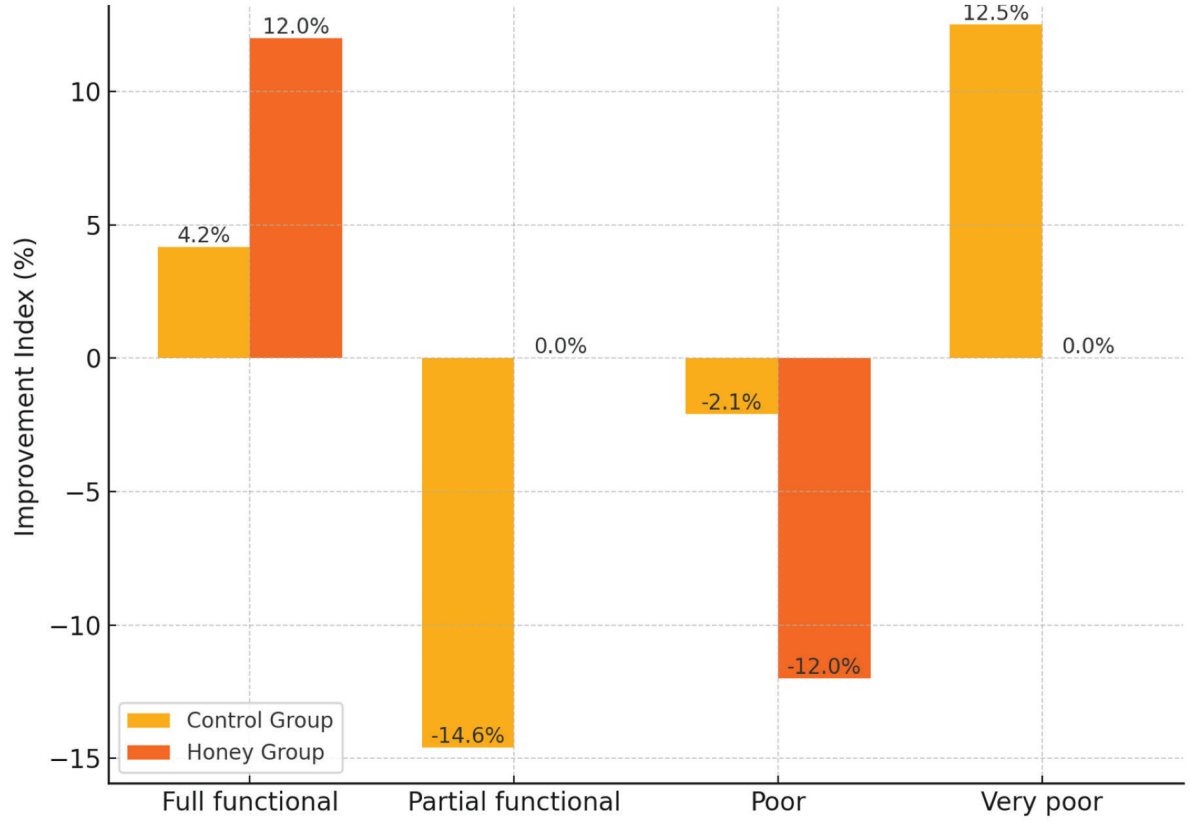

Figure 4: Factors affecting the fracture union at 6 months.

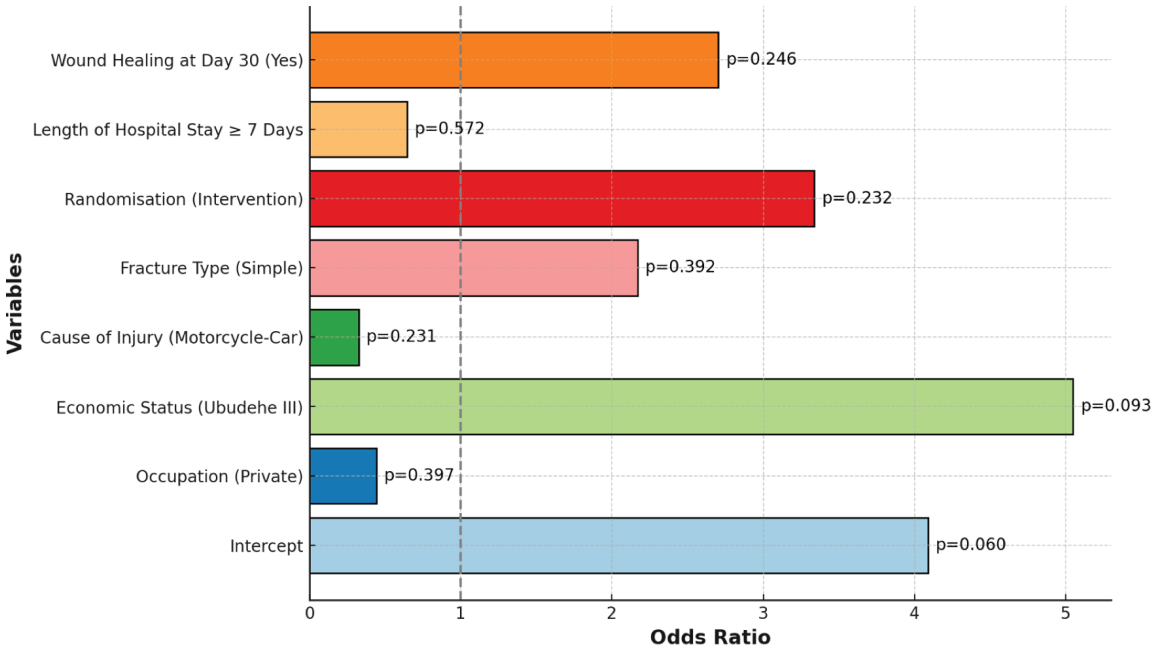

Figure 5: The comparison of Lower Extremity Functional Scale (LEFS) scores at 6 months between the Honey and Standard Dressing groups

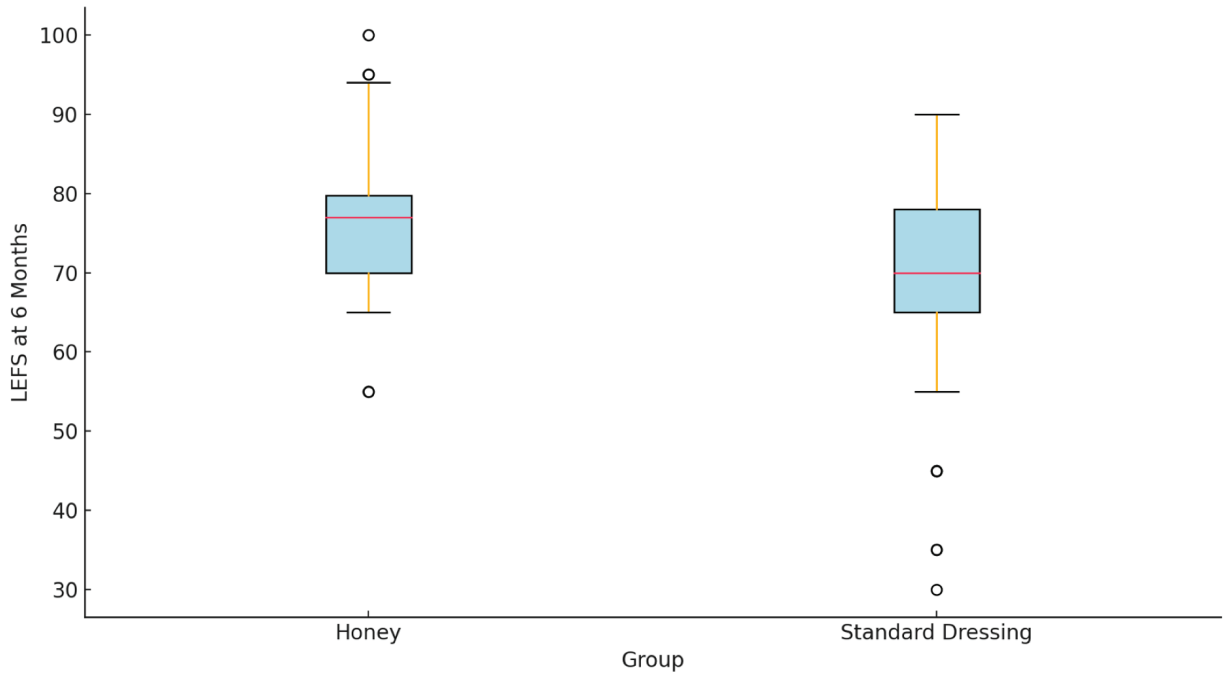

Figure 6: Factors influencing the Lower Extremity Functional Scale (LEFS) outcomes at 6 months in both groups

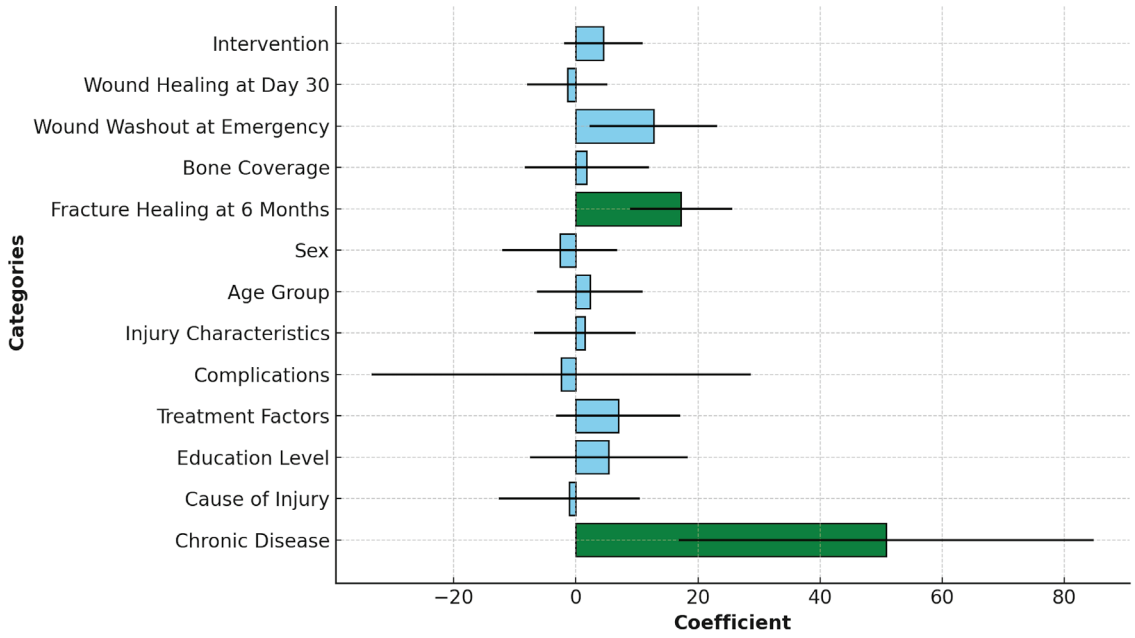

Table 1: Baseline characteristics of control and intervention groups

Factors	Control (N=48)	Intervention (N=50)	P-value
Age group			
18–30	18 (37.5%)	21 (42.0%)	
31–45	17 (35.4%)	21 (42.0%)	
>45	13 (27.1%)	8 (16.0%)	0.406
Sex			
Female	10 (20.8%)	3 (6.0%)	
Male	38 (79.2%)	47 (94.0%)	0.030
Residence			
Rural	22 (45.8%)	24 (48.0%)	
Urban	26 (54.2%)	26 (52.0%)	0.830
Education level			
None	11 (22.9%)	7 (14.0%)	
Primary	28 (58.3%)	28 (56.0%)	
Secondary	9 (18.8%)	11 (22.0%)	
University	0 (0.0%)	4 (8.0%)	0.168
Economic Status			
I	3 (6.3%)	9 (18.0%)	
II	26 (54.2%)	22 (44.0%)	
III	19 (39.6%)	19 (38.0%)	0.193
Cause of Injury			
Road Traffic Injury	31 (64.6%)	33 (66.0%)	
Fall	13 (27.1%)	10 (20.0%)	
Others*	4 (8.3%)	7 (14.0%)	0.566

**includes mining, physical assault*

Table 2: Clinical factors of the patients at admission

Factors	Control (N=48)	Intervention (N=50)	P-value
Comorbidities (HIV, DM, Hepatitis)	4 (8.3%)	4 (8.3%)	0.376
Previous same limb injury	6 (12.5%)	2 (4.0%)	0.124
Immobilisation at the Emergency	47 (97.9%)	49 (98.0%)	0.977
Wound wash out at the Emergency	44 (91.7%)	49 (98.0%)	0.154
Tetanus prevention	40 (83.3%)	48 (96.0%)	0.038
Antibiotics at the Emergency	47 (98.0%)	49 (98.0%)	0.977
Time of the 1st antibiotic from arrival			0.294
>6Hours	18 (37.5%)	24 (48.0%)	
≤6Hours	30 (62.5%)	26 (52.0%)	
Type of antibiotic at Emergency			0.269
Single* antibiotic	19 (39.6%)	22 (44.0%)	
Combined** antibiotic	29 (60.4%)	27 (54.0%)	
None	0 (0.0%)	1 (2.0%)	
Associated injury			0.489
Head injury	7 (14.6%)	5 (10.0%)	
None	41 (85.4%)	45 (90.0%)	
Side of injury			0.156
Bilateral	3 (6.3%)	1 (2.0%)	
Left	22 (45.8%)	32 (64.0%)	
Right	23 (47.9%)	17 (34.0%)	
Site of injury			0.973
Lower 1/3	23 (47.9%)	23 (46.0%)	
Middle 1/3	20 (41.7%)	22 (44.0%)	
Upper 1/3	5 (10.4%)	5(10.0%)	
Type of the fracture			0.039
Comminuted	32 (66.7%)	23 (46.0%)	
Simple	16 (33.3%)	27 (54.0%)	

**Single: Cefazolin, Cefotaxime, Ceftriaxone; **Combined: Cefotaxime & Gentamycin, Ceftriaxone & Gentamycin*

Table 3: Perioperative information of the patients in both groups

Factors	Control (N=48)	Intervention (N=50)
Type of anaesthesia		
General	4 (8.3)	0 (0.0)
Spinal	44 (91.7)	50 (100.0)
Types of procedure		
Splint	5 (10.4)	4 (8.0)
External fixator	33 (68.8)	40 (80.0)
Antibiotic Prophylaxis		
Cefazolin	4 (8.3)	5 (10.0)
Cefotaxime	2 (4.2)	0 (0.0)
Ceftriaxone	39 (81.3)	39 (78.0)
Other	3 (6.3)	6 (12.0)
Amount of Normal Saline for Irrigation (in Litres)		
<9	41 (89.1)	46 (92.0)
≥9	5 (10.9)	3 (6.0)
Estimated blood loss		
≤100	43 (89.6)	48 (96.0)
>100	5 (10.4)	2 (4.0)
Bone Coverage		
Primary closure	47 (97.9)	43 (86.0)
Not covered	1 (2.1)	7 (14.0)
Per operative transfusion		
No	44 (91.7)	45 (90.0)
Yes	4 (8.3)	5 (10.0)
Post-op antibiotics		
Single antibiotics*	4 (14.6)	6 (12.0)
Combined antibiotics**	44 (83.1)	33 (66.0)
None	0 (0.0)	1 (2.0)

**Single: Cefazolin, Cefotaxime, Ceftriaxone; **Combined: Cefotaxime & Gentamycin, Ceftriaxone & Gentamycin*

Table 4: Discharge Outcomes and 30-Day Wound Healing comparison between groups

Factors	Control (N=48)	Honey dressing (N=50)	P-value
Length of Hospital Stay			0.002
≤7	28 (58.3)	43 (86.0)	
≥7	20 (41.7)	7 (14.0)	
Surgical site infection			0.041
Yes	15 (31.3)	7 (14.0)	
No	33 (68.8)	43 (86.0)	
Wound healing at day 30			p<0.01
No	30 (62.5)	7 (14.0)	
Yes	18 (37.5)	43 (86.0)	

Table 5: Fracture union and functional outcome in both groups

Factors	Control (N=48)	Honey dressing (N=50)	P-value
LEFS at 30 days			0.189
Partial functional	0 (0.0)	1 (2.0)	
Poor	24 (50.0)	30 (60.0)	
Very poor	24 (50.0)	19 (38.0)	
LEFS at 6 months			0.002
Full functional	2 (4.2)	7 (14.0)	
Partial functional	17 (35.4)	30 (60.0)	
Poor	23 (47.9)	13 (26.0)	
Very Poor	6 (12.5)	0 (0.0)	
Fracture union at 6 months			0.046
No	9 (18.8)	2 (4.0)	
Yes	39 (81.3)	48 (96.0)	

LEFS: Lower Extremity Functional Scale

Discussion

This randomised controlled trial comparing honey dressings to standard dressings for open tibia fractures demonstrates that honey significantly promotes faster wound healing, reduces infection rates, and enhances long-term functional recovery. This section contextualises the study findings by considering demographic, clinical, and perioperative factors influencing the outcomes.

The two groups were comparable in demographic and socioeconomic characteristics, with no significant differences in age, residence, education, or occupational status. While not statistically significant, the control group included a slightly higher proportion of participants aged over 45, a demographic that may experience slower fracture healing due to comorbidities and diminished cellular activity[16]. Both groups were predominantly male, reflecting the higher incidence of open tibia fractures in rural, low-income communities where high-risk professions such as farming are common[17]. Similar educational and occupational distributions enhance the study's comparability, ensuring results are applicable

across diverse socioeconomic groups.

Pre-admission clinical characteristics, including comorbidities, previous injuries, emergency immobilisation, wound washout, and antibiotic use, were similar between groups. This similarity supports the internal validity of the study, as it suggests the faster wound healing and better recovery in the honey group can be attributed to the intervention rather than pre-existing differences in health or care. Uniform clinical management, including consistent antibiotic administration, isolates honey dressings as the primary driver of the superior outcomes observed, aligning with findings from other studies[4,8,19)].

Perioperative factors, such as anaesthesia type, surgical procedures, blood loss, and antibiotic use, were also comparable between the groups, reducing the likelihood of these factors influencing outcomes. A key difference was observed in bone exposure rates, with the honey group having more cases of uncovered bone post-surgery. Despite this, honey dressings were associated with superior wound healing and functional outcomes, suggesting their efficacy in supporting soft tissue repair, even in more challenging clinical scenarios[20, 21].

The honey group exhibited significantly faster wound healing, with 86.0% of patients achieving wound closure by day 30 compared to 37.5% in the control group ($p < 0.001$). Honey's antimicrobial properties, attributed to its high osmolarity, low pH, and natural hydrogen peroxide content, likely contributed to this outcome by reducing infection rates (14.0% in the honey group vs. 31.3% in the control group; $p = 0.041$)[22, 23]. Honey's ability to promote autolytic debridement, reduce inflammation, and enhance granulation tissue formation is well-documented in research on burns and ulcers[23]. These findings support the use of honey as an effective wound-healing agent in orthopaedic trauma care.

By six months post-treatment, the honey group demonstrated significantly better functional outcomes and fracture union rates compared to the control group. Fourteen percent of the honey group achieved full functional recovery compared to 4.2% in the control group, while 60.0% of the honey group attained partial functional recovery versus 35.4% of the control group ($p=0.002$). Fracture union rates were also significantly higher in the honey group (96.0%) than in the control group (81.3%, $p = 0.046$). These results suggest that honey dressings not only enhance wound healing but also support tissue regeneration and fracture union, consistent with prior studies[4].

Logistic regression analysis indicated that socioeconomic factors, particularly economic status, may influence fracture union outcomes. While these findings were not statistically significant, trends suggest that higher economic status might improve recovery outcomes, likely due to better access to care and resources. This highlights the importance of considering external factors in future research, as socioeconomic disparities could impact the effectiveness of treatment modalities like honey dressings.

The study's strengths include its randomised design and direct comparison of honey dressings to standard care, providing robust evidence for honey's efficacy in managing complex fractures. The key strength was the proactive follow-up and dedicated research team, who achieved high follow-up rates. However, the study's limitations include differences in fracture complexity between groups, the open-label design, which could introduce bias, and the single-centre setting, which may limit the generalizability of the results.. Larger, multi-centre trials are needed to confirm these findings and further investigate factors such as fracture complexity and socioeconomic status.

This study highlights the superior efficacy of honey dressings in promoting wound healing, reducing infection rates, and enhancing long-term functional recovery in patients with open tibia fractures compared to standard dressings. Honey's antimicrobial and regenerative properties make it a promising alternative in orthopaedic trauma care. While variability in fracture complexity and the single-centre setting may limit generalisability, these findings provide compelling evidence supporting the clinical use of honey dressings. Future research should explore multi-centre designs and examine the interaction between socioeconomic factors and recovery outcomes.

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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.

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