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Original Article

Psychological stress level surveys in patients with diabetic foot ulcers and the application effect of using loofah sponges during VSD treatment

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Abstract: Objective: To investigate the psychological stress levels in patients with diabetic foot ulcer (DFU) and evaluate the effects of using a luffa sponge in vacuum sealing drainage (VSD) treatment. Methods: This retrospective study analyzed the clinical data from 110 DFU patients treated with VSD at The First People's Hospital of Zunyi (The Third Affiliated Hospital of Zunyi Medical University) between September 2021 and October 2023. Patients were categorized into two groups based on psychological stress levels: an observation group (with psychological stress, n=42) and a control group (without psychological stress, n=68). Baseline data were analyzed to identify factors influencing psychological stress. The observation group was further divided into the conventional care group and the loofah fiber care group, each with 21 patients, to evaluate the effect of using a loofah sponge during VSD treatment. Results: Logistic regression analysis identified Wagner classification and diabetes-related distress levels as significant factors influencing psychological stress (P<0.05). Post-intervention, the loofah fiber care group showed significantly lower scores on HQ-9, GAD-7, and SRSS (all P<0.05). Additionally, the loofah fiber care group showed lower frequencies of ASD dressing changes, shorter wound healing times, shorter hospital stays, and lower VAS pain scores (all P<0.05). Quality of life scores were significantly higher in the loofah fiber care group across all dimensions (P<0.05), and DASS-21 scores were significantly lower post-intervention (P<0.05). The loofah fiber care group also demonstrated significantly better outcomes in Wagner classification and diabetes-related distress levels, with higher patient satisfaction (all P<0.05). Conclusion: This study highlights significant factors influencing psychological stress in patients with DFU and demonstrates that loofah fiber nursing interventions during VSD treatment improve psychological stress, wound healing, and quality of life. This method provides a promising approach to enhance patient outcomes and satisfaction.

Keywords: Diabetic foot ulcer, psychological stress, loofah fiber, VSD treatment, nursing interventions

Introduction

Diabetic foot ulcer (DFU) represents a challenging complication of diabetes mellitus (DM), characterized by slow wound healing and susceptibility to infection [1]. Its high prevalence poses a significant burden on patients, the healthcare systems, and society at large [1, 2]. Despite advances in wound care, DFUs remain difficult to manage, often leading to lower extremity amputations and reduced quality of life for affected individuals [3]. Moreover, the psychological stress experienced by patients with DFU is often overlooked, and it plays a pivotal role in hindering wound healing by impairing immune function and prolonging inflammation [4]. Addressing the psychological well-being of DFU patients is, therefore, essential for achieving optimal outcomes. However, few studies have systematically assessed psychological stress levels in DFU patients, explored factors that contribute to psychological stress in DFU patients, and implemented interventions to reduce stress in this population [5, 6]. This gap underscores the need for further research to explore the psychological impact of DFUs and identify effective strategies for alleviating it.

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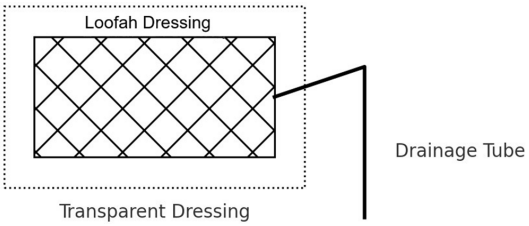

Figure 1. Schematic diagram of the application of loofah dressing. The treatment shows the use of the loofah, covered by a transparent dressing with a tube for drainage, depicted from multiple angles.

Physiological effects of various interface dressings have been studied in the context of negative pressure wound therapy (NPWT) [7, 8]. Loofah sponges, derived from the fiber skeleton of the loofah plant, possess antibacterial, anti-inflammatory, and wound-healing effects [9]. Studies have demonstrated that loofah sponges yield results comparable to gauze or foam dressings but are more cost-effective, making them a promising alternative [10]. However, their application in conjunction with vacuum sealing drainage (VSD) therapy and their impact on psychological stress levels in DFU patients remian unkonwn. Therefore, this study aims to assess psychological stress levels in DFU patients and evaluate the effect of using a loofah sponge during VSD therapy. By elucidating the psychological impact of DFUs and exploring novel interventions, this study seeks to improve our understanding of DFU management and improve patient outcomes. This study may inform developing holistic care approaches that address both the physical and psychological dimensions of healing.

Materials and methods

General data

This study was approved by the Ethics Committee of The First People's Hospital of Zunyi (The Third Affiliated Hospital of Zunyi Medical University). This retrospective study analyzed clinical data from 110 DFU patients treated with VSD at The First People's Hospital of Zunyi (The Third Affiliated Hospital of Zunyi Medical University) from September 2021 to October 2023. Patients were divided into the observation group (with psychological stress, n=42) and control group (without psychological stress, n=68) based on their psychological stress levels. The observation group was further categorized into the conventional care group and the loofah sponge care group, with 21 patients in each group.

Inclusion criteria: ① Patients who met the diagnostic criteria for diabetic foot ulcer [11]; ② Wounds classified as grade 2-5 ulcers according to the Wagner classification; ③ Age >18 years; ④ Complete clinical data available.

Exclusion criteria: ① Foot ulcers caused by venous insufficiency or trauma; ② Ulcers with malignant transformation; ③ Patients with coagulation disorders; ④ Patients with severe malnutrition; ⑤ Patients with recent use of glucocorticoids.

Nursing methods

The control group received conventional care, including regular blood glucose monitoring, routine wound dressing changes, simple dietary guidance, and standard health education. Preoperatively, VSD-related materials were prepared, and aseptic procedures were strictly followed during surgery. Postoperative care included proper fixation of the drainage tubes and close monitoring of the patient's condition. The Depression-Anxiety-Stress Scale 21 (DASS-21) was utilized to assess the improvements in patients' emotional states, covering three dimensions: depression, anxiety, and stress, with a total of 21 items. Each item was scored from 0 to 3, with higher scores reflecting more severe negative emotional symptoms. The total score ranged from 0 to 84, with higher scores indicating greater levels of negative emotions. Patients scoring >21 were included in the observation group, while those scoring ≤21 were included in the control group [13].

The observation group, comprising 42 patients with psychological stress, was further subdivided into two sub-groups: the Loofah Fiber Group and the Conventional Care Group. Each sub-group included 21 patients. The Loofah Fiber Group received additional care involving the use of loofah sponge dressings alongside conventional care, while the Conventional Care Group followed standard nursing protocols = including regular blood glucose monitoring, routine wound dressing changes, simple dietary guidance, and standard health education. The schematic diagram of the care procedure is shown in **Figure 1**.

① Selection of VSD installation site: Sites with thicker subcutaneous fat and muscle tissue, typically the posterior calf or thigh, were selected for VSD installation.

② Device installation steps: Following the VSD surgical protocol, the test site was disinfected with alcohol. A non-toxic sponge or hand sanitizer gel pad infused with methylene blue was placed on the skin, then covered with a loofah sponge. Drainage and irrigation tubes were inserted into the loofah sponge, and the membrane was fixed to the loofah sponge and skin. The drainage and irrigation tubes were secured, and the drainage tube was connected to a latex tube leading to a drainage bottle, which was connected to a central vacuum facility set to -125 to -45 mmHg.

③ Inspection and observation of the vacuum sealing drainage device: All seals and connections were checked for completeness. When a 2 ml or 5 ml syringe was inserted into the irrigation tube, the wound dressing material contracted and formed a vacuum. Methylene blue test solution or hand sanitizer test gel was aspirated through the vacuum drainage tube, and irrigation fluid injected into the loofah sponge dressing material was also extracted, indicating effective vacuum sealing.

④ Monitoring during continuous suction: Over a 12-hour perioperative period, the patency of the drainage tube, suction force, and peripheral circulation were closely monitored. The patient experienced no discomfort, irrigation was smooth, and irrigation fluid was freely drained. Upon removal of vacuum-sealing drainage device, the peripheral circulation of the skin was intact, confirming the device's efficacy.

Observation indicators

① Baseline data of patients in both groups: The baseline data for patients in both groups include key parameters: age, gender, duration of diabetes, and Wagner classification of ulcers. The Wagner classification is detailed as described in "Guidelines for the Prevention and Treatment of Diabetic Foot Ulcers (2019 edition)" in China. Grade II: deeper ulcer with soft tissue inflammation, no abscess or bone infection; Grade III: deep ulcer with abscess or osteomyelitis; Grade IV: localized gangrene affecting the toe, heel, or dorsum of the foot; and Grade V: extensive or complete foot gangrene. Additionally, diabetes-related distress levels were measured using scoring method [12], with a mean score of 2.0 as the cutoff; scores below 2.0 indicate no distress, scores between 2.0 and 3.0 indicate moderate distress, and scores of 3.0 or higher indicate severe distress, with a particular focus on differentiating between moderate and severe distress. Other baseline factors included marital status, monthly income, living conditions, education level, exercise participation, diastolic blood pressure, systolic blood pressure, and heart rate.

② Factors influencing patients' psychological stress: This category includes observed factors that may contribute to psychological stress in DFU patients.

③ Pre- and post-nursing scores of HQ-9, GAD-7, and sleep status (SRSS) in patients with psychological stress: The SRSS includes 10 items, each scored on a 5-point scale (1 to 5 points per item). Higher scores indicate more severe sleep problems. The SRSS score ranges from 10 (no sleep problems), to 50 (severe sleep problems).

④ Recovery indicators in patients with psychological stress: This includes the number of ASD dressing changes, wound healing time, hospital stay duration, and VAS score.

⑤ Post-nursing quality of life in both groups: Quality of life was assessed using the SF-36 scale, covering psychological function, physical function, environment, and social function.

⑥ Post-nursing DASS-21 scores: The DASS-21 scores after nursing care were observed.

⑦ Post-nursing Wagner classification and diabetes-related distress levels: The changes in the Wagner classification of ulcers and diabetes-related distress levels after nursing care were observed.

⑧ Nursing satisfaction in patients with psychological stress: Patient satisfaction was assessed using a self-made satisfaction questionnaire from our hospital, covering four dimensions: service attitude, nursing skills, nursing environment, and nursing quality. The total score ranges from 0 to 100, with <60 being dis-

satisfied, 60-80 being generally satisfied, and ≥80 being very satisfied. Total nursing satisfaction (%) = (number of very satisfied cases + number of generally satisfied cases)/total cases × 100%.

Statistical methods

Data analysis was conducted using SPSS 22.0. The Shapiro-Wilk test assessed normal distribution of data. Normally distributed data were expressed as mean ± standard deviation and compared with independent sample t-tests or paired sample t-tests for pre- and post-nursing. Non-normally distributed data were shown as median (P25, P75) and compared with the Mann-Whitney U test or Wilcoxon signed-rank test. Categorical data were presented as percentages. The χ^2 test, continuity correction, or Fisher's exact test were used based on sample size and theoretical frequency. Logistic regression analysis was conducted to identify influencing factors. A *p*-value of <0.05 was considered statistically significant.

Results

Comparison of baseline data between the observation group and control group

The average DASS-21 score for all patients was (26.34±10.77), with the observation group scoring (38.57±7.13) and the control group scoring (18.78±2.39). There were no significant differences between the two groups in terms of general baseline data (P>0.05). However, A significantly higher proportion of patients in the observation group had severe ulcers (Wagner grade IV-V) compared to the control group (47.62% vs. 20.59%, P=0.003). A larger proportion of patients in the observation group experienced severe diabetic distress (64.29%) compared to the control group (32.35%) (P=0.001). A larger proportion of patients in the observation group were divorced or widowed (52.38%) compared to the control group (30.88%) (P=0.025) (**Table 1**).

Logistic regression analysis for factors associated with DFU psychological stress

Logistic regression analyses was used to explore factors affecting psychological stress in patients. The results showed that ulcer severity (Wagner grading) and diabetic pain level were the significant factors influencing psychological stress (both P<0.05). Patients with Wagner grade IV-V were three times more likely to experience psychological stress than those with lower-grade ulcers (OR=3.059), and patients with higher diabetic pain levels were 3-fold more likely to be psychologically stressed than patients with lower-grade pain levels (OR= 3.267) (**Table 2**). These results highlight the significant impact of ulcer severity and diabetic pain level on psychological stress in patients with DFU.

Comparison of clinical data between stressed patients in the loofah fiber group and conventional group

The comparison of clinical data revealed no significant differences between the two groups regarding gender distribution, age, duration of diabetes (P=0.479), or other variables examined (**Table 3**).

Comparison of depression, anxiety, and sleep status between the loofah fiber group and conventional group before and after care

The analysis of HQ-9, GAD-7, and SRSS scores before and after nursing intervention showed no significant differences between the two groups prior to intervention (HQ-9: P=0.944; GAD-7: P=0.955; SRSS scores: P=0.909). However, after nursing intervention, patients in the observation group exhibited significantly lower scores in HQ-9, GAD-7, and SRSS (all P<0.001) compared to those in the control group (**Table 4**). This suggests that the use of loofah sponge dressing contributed to improved depression, anxiety, and sleep quality among DFU patients.

Comparison of recovery outcomes between the loofah fiber group and conventional group

In the Loofah fiber group, patients exhibited a significantly lower frequency of ASD material changes (1.86±0.57 vs. 3.52±1.03, P<0.001), shorter wound healing time (12.48±5.24 vs. 22.33±5.24 days, P<0.001), reduced hospitalization duration (16.90±4.24 vs. 25.33±5.24 days, P<0.001), and lower VAS scores (4.24± 2.07 vs. 7.81±2.38, P<0.001), suggesting that the implementation of Loofah sponge dressing resulted in improved wound healing outcomes and reduced pain levels among DFU patients (**Table 5**).

Table 1. Comparison of baseline data between the observation and control group

	Observation Group (n=42)	Control Group (n=68)	t/χ^2	P
Age (years)	48.81±6.19	49.00±6.81	-0.148	0.883
Gender [n (%)]			0.128	0.72
Male	22 (52.38)	38 (55.88)		
Female	20 (47.62)	30 (44.12)		
Duration of Diabetes (years)	9.45±1.50	9.26±1.71	0.586	0.559
Wagner Classification [n (%)]			8.883	0.003
Grade II-III	22 (52.38)	54 (79.41)		
Grade IV-V	20 (47.62)	14 (20.59)		
Diabetes-Related Distress [n (%)]			10.718	0.001
Moderate	15 (35.71)	46 (67.65)		
Severe	27 (64.29)	22 (32.35)		
Marital Status [n (%)]			5.04	0.025
Unmarried or Married	20 (47.62)	47 (69.12)		
Divorced or Widowed	22 (52.38)	21 (30.88)		
Monthly Income [n (%)]			0.055	0.815
≤3000 Yuan	25 (59.52)	42 (61.76)		
>3000 Yuan	17 (40.48)	26 (38.24)		
Living Situation [n (%)]			0.131	0.717
Living Alone	15 (35.71)	22 (32.35)		
Living with Others	27 (64.29)	46 (67.65)		
Education Level [n (%)]			0.058	0.81
High School or Below	12 (28.57)	18 (26.47)		
College or Above	30 (71.43)	50 (73.53)		
Participation in Exercise [n (%)]			0.023	0.878
Yes	13 (30.95)	22 (32.35)		
No	29 (69.05)	46 (67.65)		
Diastolic Blood Pressure (mmHg)	100.74±6.80	100.15±6.91	0.438	0.662
Systolic Blood Pressure (mmHg)	130.43±6.63	130.25±6.93	0.134	0.894
Heart Rate (beats/min)	85.48±5.96	85.93±6.28	-0.373	0.71

Table 2. Logistic regression analysis of factors associated with psychological stress in patients

Model	β	SE	Wald	P	OR	95% CI
Wagner Classification	1.118	0.455	6.033	0.014	3.059	1.253-7.464
Diabetes-Related Distress	1.184	0.433	7.461	0.006	3.267	1.397-7.642
Marital Status	0.742	0.437	2.855	0.089	2.1	0.892-4.946
Constant	-1.734	0.392	19.51	<0.001	0.177	-

Table 3. Comparison of clinical data between the loofah fiber group and conventional group

Group	Age (years)	Gender		Duration of Diabetes (years)
		Male (%)	Female (%)	
Loofah Fiber Group (n=21)	48.19±5.34	12 (57.14)	9 (42.86)	9.62±1.43
Conventional Group (n=21)	49.43±7.00	10 (47.62)	11 (52.38)	9.29±1.59
t/χ^2	-0.644	0.382		0.715
P	0.523	0.537		0.479

Table 4. Comparison of HQ-9, GAD-7, and SRSS scores between the loofah fiber group and conventional group before and after treatment ($\bar{x}\pm s$)

Group	HQ-9 (points)		t	P	GAD-7 (points)		t	P	SRSS (points)		t	P
	Before Care	After Care			Before Care	After Care			Before Care	After Care		
Loofah Fiber Group (n=21)	15.86±4.28	8.29±3.12	6.206	<0.001	12.24±2.51	5.57±1.96	8.699	<0.001	25.14±8.05	14.90±5.54	5.749	<0.001
Conventional Group (n=21)	15.95±4.43	12.86±3.90	2.573	0.018	12.29±2.87	9.76±2.47	3.344	0.003	25.43±7.9	20.52±7.20	2.141	0.045
T	-0.071	-4.195			-0.057	-6.089			-0.116	6.188		
P	0.944	<0.001			0.955	<0.001			0.909	<0.001		

Table 5. Comparison of ASD dressing changes, wound healing time, hospital stay, and VAS scores between the loofah fiber group and conventional group ($\bar{x}$±s)

Group	ASD Dressing Change Frequency (times)	Wound Healing Time (days)	Hospital Stay Duration (days)	VAS Score (points)
Loofah Fiber Group (n=21)	1.86±0.57	12.48±5.24	16.90±4.24	4.24±2.07
Conventional Group (n=21)	3.52±1.03	22.33±5.24	25.33±5.24	7.81±2.38
t	-6.477	-6.097	-5.744	-5.188
P	<0.001	<0.001	<0.001	<0.001

Table 6. Comparison of quality of life indicators between the loofah fiber group and conventional group ($\bar{x}$±s, points)

Group	Psychological Function	Physical Function	Environment	Social Function
Loofah Fiber Group (n=21)	92.76±5.42	91.86±5.11	92.34±5.30	91.48±5.90
Conventional Group (n=21)	82.48±6.30	81.24±5.35	82.05±5.82	80.48±5.92
t	5.672	6.578	5.934	6.033
P	<0.001	<0.001	<0.001	<0.001

Table 7. Comparison of DASS-21 Scores between the loofah fiber group and conventional group ($\bar{x}$±s, points)

Group	DASS-21 Score
Loofah Fiber Group (n=21)	19.67±5.75
Conventional Group (n=21)	29.76±7.22
t	-5.014
P	<0.001

Comparison of quality of life between the loofah fiber group and conventional group before and after nursing

The comparison of life quality indicators before and after nursing care revealed significant improvements in the observation group across all measured aspects. The observation group had higher scores in psychological function (92.76±5.42 vs. 82.48±6.30), physiological function (91.86±5.11 vs. 81.24±5.35), environmental factors (92.34±5.30 vs. 82.05±5.82), and social function (91.48±5.90 vs. 80.48±5.92) (**Table 6**) compared to those in the conventional group. These findings suggest that the application of loofah sponge dressing contributed to an overall improvement in the life quality of patients with DFU.

Comparison of DASS-21 scores between the loofah fiber group and conventional group after nursing

Following the nursing intervention, patients in the Loofah fiber group demonstrated significantly lower DASS-21 scores (19.67±5.75 vs. 29.76±7.22, P<0.001) than the conventional group, as shown in **Table 7**. This indicates a notable reduction in depressive, anxious, and stress-related symptoms among patients receiving loofah sponge dressing therapy for DFU.

Comparison of post-care Wagner classification and diabetic distress levels between the loofah fiber group and conventional group

The outcomes post-care indicated that the observation group had better ulcer and pain grades. Specifically, the observation group had a higher proportion of patients with Wagner grades II-III ulcers (90.48%) compared to the control group (61.90%), while fewer patients had grades IV-V ulcers (9.52% vs. 38.10%) (P<0.05). Similarly, a greater number of patients in the observation group experienced moderate diabetes pain (90.48%) compared to those in the control group (57.14%), with fewer patients reporting severe pain (9.52% vs. 42.86%) (P<0.05) (**Table 8**; **Figure 2**). These findings suggest that loofah sponge dressing contributed to improved wound healing and reduced pain severity in DFU patients.

Comparison of post-care patient satisfaction between the loofah fiber group and conventional group

Following nursing intervention, patients in the Loofah fiber group reported significantly higher satisfaction rates. Specifically, the Loofah fiber

Table 8. Comparison of Wagner classification and diabetic distress levels between the loofah fiber group and conventional group

Group	Wagner Classification		Diabetic Distress Level	
	II-III	IV-V	Moderate	Severe
Loofah Fiber Group (n=21)	19 (90.48)	2 (9.52)	19 (90.48)	2 (9.52)
Conventional Group (n=21)	13 (61.90)	8 (38.10)	12 (57.14)	9 (42.86)
χ^2	4.725		6.035	
P	0.030		0.014	

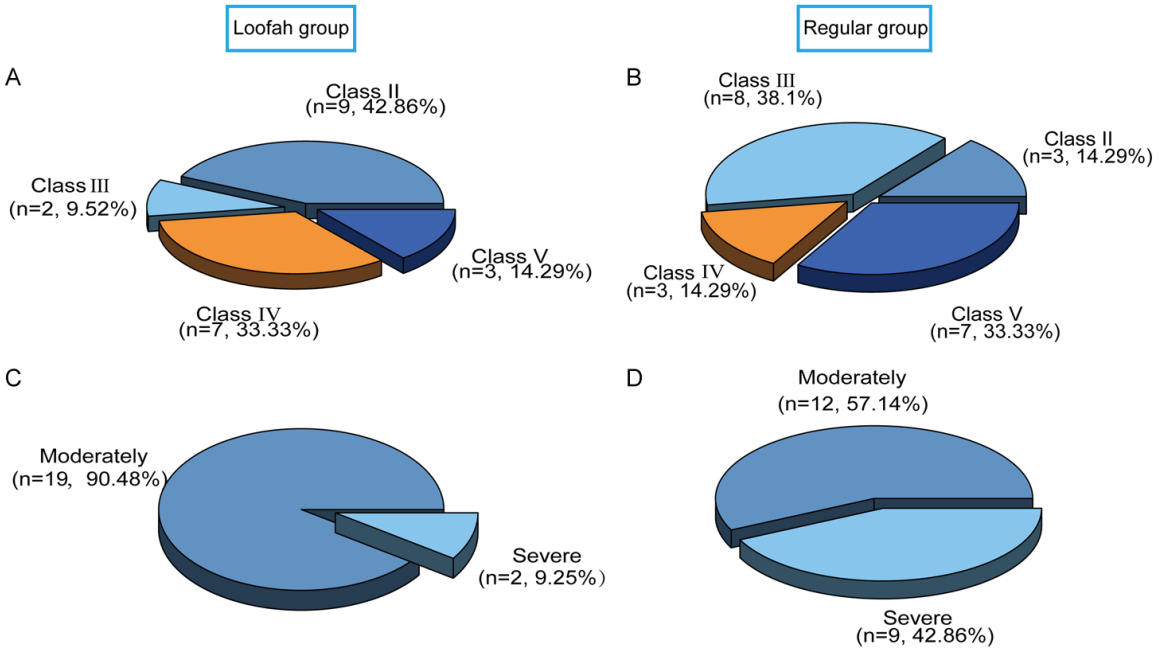

Figure 2. Pie charts of Wagner grading for ulcer and pain grading of diabetes. A (Loofah group - Wagner grading): Class II (42.86%, n=9), Class III (9.52%, n=2), Class IV (33.33%, n=7), and Class V (14.29%, n=3). B (Regular group - Wagner grading): Class II (14.29%, n=3), Class III (38.1%, n=8), Class IV (14.29%, n=3), and Class V (33.33%, n=7). C (Loofah group - Pain level): Moderate pain (90.48%, n=19) and Severe pain (9.52%, n=2). D (Regular group - Pain level): Moderate pain (57.14%, n=12) and Severe pain (42.86%, n=9).

group reported a higher proportion of patients with either general or high satisfaction levels (95.24% vs. 80.95%), while fewer patients reported dissatisfaction (4.76% vs. 28.57%) compared to the conventional group (all P< 0.05). These findings suggest the utilization of loofah sponge dressing contributed to enhanced patient satisfaction (**Table 9**).

A case of diabetic ulcer treated with loofah dressing

A severe case of diabetic foot ulcer was treated over several weeks using a combination of loofah sponge dressing and negative pressure wound therapy (NPWT). The patient initially presented with extensive tissue damage and open wounds, typical of advanced diabetic foot ulcers. After the initial application, significant improvement was observed, with noticeable signs of healing and reduced inflammation. A second round of treatment further promoted wound contraction and healing. By the end of the treatment, the ulcer had notably reduced in size, with a cleaner and healthier wound bed, indicating that the loofah sponge dressing, alongside NPWT, was an effective treatment for severe diabetic foot ulcers. The treatment process is illustrated in **Figure 3**.

Discussion

Diabetic foot ulcer (DFU) is a severe complication of diabetes mellitus that harms both the

Table 9. Comparison of patient satisfaction between the loofah fiber group and conventional group (n, %)

Group	Unsatisfied (%)	Generally Satisfied (%)	Very Satisfied (%)	Total Satisfaction Rate (%)
Loofah Fiber Group (n=21)	1 (4.76)	8 (38.10)	12 (57.14)	20 (95.24)
Conventional Group (n=21)	6 (28.57)	8 (38.10)	7 (33.33)	15 (80.95)
χ^2				4.286
P				0.038

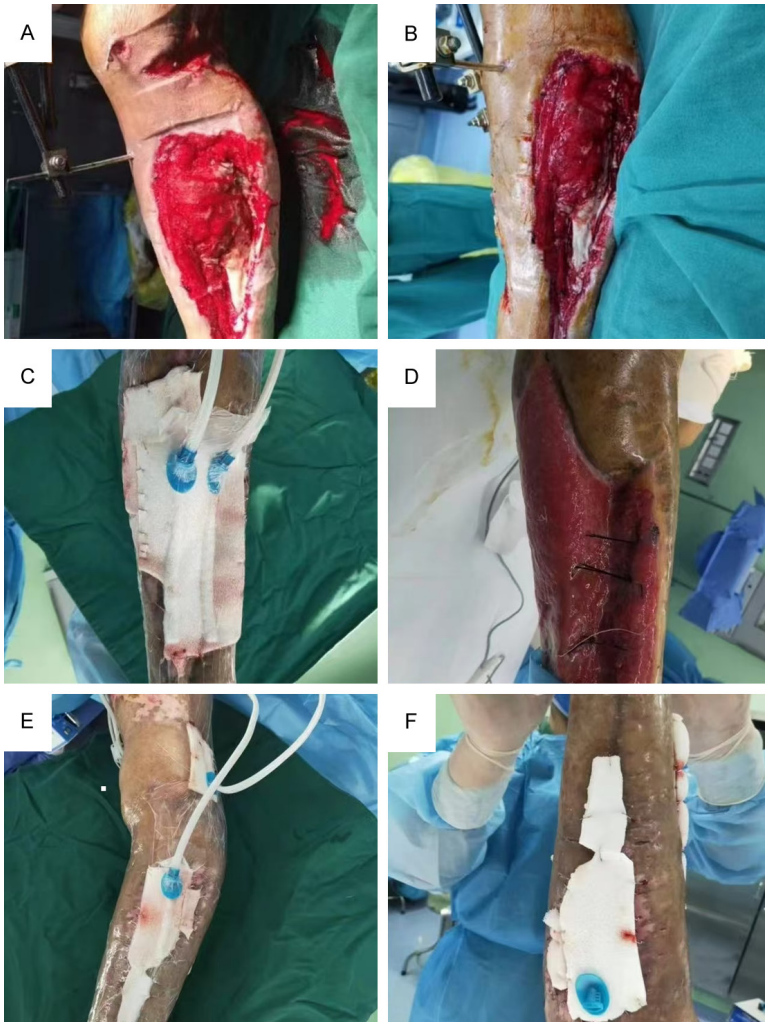

Figure 3. A case of diabetic ulcer treated with loofah dressing. (A, B) (Pre-treatment Stage): (A) Extensive tissue damage with open wound, pre-treatment. (B) Severe ulceration with exposed granulation tissue before treatment. (C) (First Treatment Application): Initial application of loofah dressing with negative pressure therapy. (D) (Post First Treatment): Wound showing early healing signs after the first treatment. (E, F) (Second Treatment and Post-treatment): (E) Second application of loofah dressing with continued negative pressure. (F) Significant wound contraction and reduced inflammation post-treatment.

physical and psychological well-being of affected patients. This study aimed to investigate the factors influencing psychological stress in DFU patients and to evaluate the effectiveness of loofah sponge during VSD therapy in alleviating this stress and improving wound healing.

Our findings highlight several critical factors influencing psychological stress in DFU patients. Logistic regression analysis revealed that ulcer severity, as classified by the Wagner system, and diabetes-related distress levels were significant predictors of psychological stress. This underscores the importance of considering both clinical and psychosocial dimensions when managing DFU patients. Socio-demographic factors, such as income, and education level, also played a role, reflecting the multifaceted nature of psychological stress in this population [14].

Diabetic foot poses a significant challenge for patients with diabetes, with current research focusing on promoting local ulcer healing, reducing healing time, and decreasing amputation rates [15]. Traditional clinical treatments have largely emphasized systemic approaches, often overlooking the importance of local treatments, which can lead to wounds that are difficult to heal [16, 17]. Common local treatments in modern medicine include debridement with

hydrogen peroxide and saline, followed by wet compresses with antibiotics, insulin diluents, or iodophor, as well as various dressings [18]. However, hydrogen peroxide can be corrosive to skin and mucosa, expanding the wound and hindering granulation tissue growth, making it less favorable [19]. Antibiotics can lead to resistance and double infections, and iodophor may cause cautery effects and allergic reactions in some patients [20]. Dressings, while useful, can be expensive and less effective for large ulcers with significant secretions [21]. Advanced techniques, including vascular mediation, artery bypass, and stem cell transplantation, offer promising solutions for limb salvage. However, with high costs, technological demands, and invasiveness, their accessibility and acceptance among patients are limited [22].

In this study, we investigated the efficacy of loofah sponge combined with VSD therapy for patients with DFUs. Our results demonstrate that loofah sponge application can significantly enhance ulcer healing, reduce healing time, and lower amputation rates. Specifically, the loofah fiber group showed significantly lower frequencies of ASD dressing changes (mean 2.3 times vs. 4.1 times), shorter wound healing times (mean 28.5 days vs. 42.3 days), shorter hospital stays (mean 15.2 days vs. 25.7 days), and lower VAS pain scores (mean 2.8 vs. 4.6). Modern pharmacological research has indicated that the charcoal derived from the loofah could enhance drug adsorption and bactericidal and astringent properties [23, 24]. Traditional Chinese medicine attributes diabetic foot to Qi and Yin deficiency, blood obstruction, and limb loss. Dampness, heat, stasis, and toxins are believed to block veins and corrupt skin and bones, leading to gangrene. Loofah charcoal, characterized by its sweet taste and non-toxic nature, is reputed for its functions in dissolving rot, generating muscle, reducing swelling, detoxifying, activating blood, clearing collaterals, and providing astringent effects [25]. Clinical practices emphasize improving vascular endothelial function, expanding peripheral blood vessels, enhancing blood flow, and promoting microcirculation as key principles the management of diabetic foot ulcers [26-28].

Conclusion

The application of loofah sponge dressing significantly improves psychological stress, quality of life, and wound healing in patients with diabetic foot ulcers compared to traditional nursing care. Loofah charcoal is easily obtainable, cost-effective, free from toxic side effects, and well-accepted by patients. Prepared in a clean environment (class 100,000 clean room), loofah charcoal powder is convenient for clinical use. This intervention offers a feasible, simple, and cost-effective method suitable for basic hospitals, enhancing patient treatment outcomes and satisfaction. Our findings support the clinical application of loofah fiber as an innovative nursing intervention for DFU management.

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Disclosure of conflict of interest

None.

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