

## ORIGINAL ARTICLE

**Comparison of Hydrogel and Papaya Dressings in the Treatment of Diabetic Foot Ulcers**MUHAMMAD RIZWAN<sup>1</sup>, ZAHID RASHEED<sup>2</sup>, NATASHA KANWAL MIRZA<sup>3</sup>, GUL NAZ<sup>4</sup>, SAULEHA SAYYED<sup>5</sup>, MUHAMAMD KHURRAM JAMEEL<sup>6</sup>, FAWAD HAMEED<sup>7</sup><sup>1</sup>Consultant General Surgeon, DHQ Hospital, Jhelum<sup>2</sup>Registrar Surgery, Farooq Hospital Rawalpindi Branch, Rawalpindi<sup>3</sup>Women Medical Officer, DHQ Hospital, Jhelum<sup>4</sup>Senior Registrar Surgery, Ghulam Devi Hospital Lahore<sup>5</sup>Women Medical Officer, Farooqui Dental & Medical Centre, Lahore<sup>6</sup>Assistant Professor of Surgery, Azra Naheed Medical College, Lahore<sup>7</sup>Associate professor surgery, Azra Naheed Medical College, LahoreCorresponding author: Muhammad Rizwan, Email: [dr.rizwanmaqsood@gmail.com](mailto:dr.rizwanmaqsood@gmail.com)**ABSTRACT**

Diabetes mellitus is the most common metabolic problem all over the world. Over 150 million people worldwide, are affected with this problem.<sup>1,2</sup> In Pakistan, the prevalence of diabetic patients are between 7.6% to 11%.<sup>3</sup>

**Objective and Methodology:** The aim of this study is to compare the relative efficacy of hydrogel and papaya dressings for diabetic foot ulcers. Patients from the General Surgery Department at Mayo Hospital in Lahore were 114 in total. Patients were randomized into: group H, who received hydrogel dressings, and group P, who received papaya dressings. Both dressings were done in ward for 20 days, every 48 hours and if wound healing occurred earlier and slough decreased then dressings were stopped and patient was discharged. The wound was assessed by photographic wound assessment tool (PWAT).

**Results:** In Group P, mean age of patients was 52.98±8.90 and in Group H, mean age of patients was 50.98±9.62. In Group P, 34(59.6%) patients were male and 23(40.4%) were female. While in Group H 29(50.9%) patients were male and 28(49.1%) were female patients. We used Wound Assessment tool "PWAT" to compare the efficacy of these two treatment regimes. As per final "PWAT" score hydrogel dressing is more effective as compared to Papaya dressing for diabetic wound healing. i.e. Group P (Papaya dressing): 5.09±1.65 vs. Group H (hydrogel Dressing): 6.02±1.78, p-value=0.005

**Conclusion:** Depending upon the outcomes of this research, it can be concluded that hydrogel dressing is more useful than papaya dressing for treating diabetic wound. Although papaya dressing also have a beneficial effect on diabetic wound but still its efficacy is less as compared to hydrogel dressing

**Keywords:** Papaya, Hydrogel, Dressing, Diabetic Foot, Wounds, Ulcer.

**INTRODUCTION**

Diabetes mellitus is the most common metabolic problem all over the world. Over 150 million people worldwide, are affected with this problem.<sup>1,2</sup> In Pakistan, the prevalence of diabetic patients are between 7.6% to 11%.<sup>3</sup> The most common complication of these patients are diabetic foot ulcers. Diabetic foot ulcers are a major complication of long-standing diabetes, especially if it is poorly controlled. It enhances the morbidity and mortality of diabetic patients with the complications of this disease. More than 15% of these patients have an increased risk of diabetic foot ulcers in their lifetime.<sup>4</sup>

Diabetic foot ulcers have a very big influence on the economic burden of a country, due to its non-healing nature.<sup>5,6</sup> Complete debridement of dead and dying tissue is very important to get healthy margins, which help in rapid healing of that ulcers. There are lots of different type of dressings, being used in the management of diabetic foot patients. These dressings are vacuum suction dressings, platelet rich plasma dressings, saline soaked dressing, povidone iodine soaked dressings, honey dressings, medicated dressings, hydrogel and papaya dressings.<sup>7</sup>

Green papaya has two very important enzymes named papain and chymopapain, which have the ability to liquify the dead tissue. Extracts of papaya have a very strong activity against the different bacteria found in the diabetic foot patients. The papaya has its efficacy in preventing the growth and killing the bacteria and fungi.<sup>8</sup> Hydrogel dressings are made up of a combination of different polymers with 96% of water. They let the oxygen and water vapours to pass through it and permeability of fluid and bacteria depends upon the type of dressing used with it.<sup>9</sup>

Hydrogels hydrate the wound and thus help in the moisturizing the wound. It also facilitates the natural autolysis of the dead tissue. Autolysis is the automatic breakdown of devitalised tissue, and this process is enhanced in the presence of moisture.<sup>13</sup> In people with diabetes, autolysis is often impaired as the result of inhibition of leucocyte activity: thus, dressings that provide a moist environment can facilitate autolysis. A variety of hydrogel dressings are currently available and their properties

have been reported in a large number of clinical trials and case studies. Their ability to donate water and absorb fluid varies according to their formulation.<sup>9</sup>

Saline dressing reduced necrotic tissue by 15.54±4.86 and papaya dressing by 19.93±5.29. Papaya dressing had 95.09±2.45 mean granulation tissue formation and saline 85.9±0.70. Papaya dressing healed 78% of wounds and standard saline dressing 72% at follow-up.<sup>10</sup> In another study, 83.0% of patients were male. These individuals were debrided (67.2%) or amputated (33.8%). 89.0% of patients used papaya after debridement. 6(7%) patients required further debridement, and 4(4%) required amputation.<sup>11</sup>

In another investigation, hydrogel and saline had comparable mean slough at all intervals (p>0.050). The mean Slough decrease on day five (6.93±6.14% vs. 4.37±2.96%; p=0.045), day ten (15.22±7.40% vs 9.10±7.00%; p=0.002), and day fifteen (21.57±8.71% vs 15.90±8.11%; p=0.012) was considerably higher than group B.<sup>12</sup>

Due to a deficiency of local research and conflicting worldwide literature, this study compares hydrogel and papaya dressing for diabetic wounds. This study will improve future patient management.

**MATERIALS AND METHODS**

The goal of this study is to examine the relative efficacy of hydrogel and papaya dressings for diabetic foot ulcers. From the date of the approved study summary, researchers in the Surgical Department at Mayo Hospital in Lahore gathered data for a comparative study.

Nonprobability consecutive sampling was employed for this study's data collection. A Sample size of 114(57 in each group) is calculated by 95% confidence level and 80% power of test and taking expected mean reduction in slough/necrotic tissue 19.93±2.2<sup>(9)</sup> in papaya dressing and 21.5±3.7<sup>(12)</sup> in hydrogel dressing in patients with diabetic wounds.

In the inclusion criteria, the criteria for selecting the sample are Patients with diabetic wounds (as defined operationally) and Post-operative wound dehiscence Wagner's grades II and III are

included. Patients can be of either sex. However, patients with Wagner's grade IV (severely infected) ulcers, those with diabetes and peripheral vascular disease (such as renal artery stenosis, burger's disease, Raynaud's syndrome, peripheral artery disease, or disseminated intravascular coagulopathy) often develop diabetic foot, patients with advanced liver illness, kidney disease, or haematological disease, all of which impair the body's ability to heal wounds; immunocompromised patients taking steroids or undergoing chemotherapy or radiation and patients with burns were excluded.

Total 114 patients who were having the diabetic foot and satisfying the inclusion criteria were added in the study from General Surgery Department, Mayo Hospital, Lahore. Informed consent was taken from each patient. Patients will be segregated into two groups by lottery method, Group H, which included the patients with hydrogel dressing and group P, which included the patients with papaya dressing. Name of the patient was written on a slip and put in a box. Then the patient was assigned to that specific group.

In Group H, patients were treated with hydrogel dressing and in Group P, patients were treated with Papaya dressing. Measurement of ulcer will be done by using sterile gauze and graph paper. Area of ulcer will be calculated in Sq.cm. Measurement in reduction and granulation tissue size was measured in sq.cm. In hydrogel dressing, we will be soaked gauze pieces with hydrogel and will do dressing every 48 hours. Then will continuously check patient's wound and its healing by granulation tissue appearance. In papaya dressing, early management with proper antibiotics, debridement of dead and necrotic tissue or amputation, good glycaemic control will be included and then wound was managed with papaya dressings. The outer layer and seeds of the papaya were discarded and the rest of the fruit was made like a paste.

Patients and attendants both were guided for the dressing. Both dressings were done in ward for 20 days, every 48 hours and if wound healing occurred earlier and slough decreased then dressings were stopped and patient was discharged. The wound was assessed by photographic wound assessment tool (PWAT). Images were taken by digital camera. While taking the photographs, special attention was given on the brightness and picture quality with good resolution. Photographs were taken after receiving the patient's written permission with the understanding that the patient's identity will not be revealed at any cost.

After taking the picture of the wound, wound will be rated according to the PWAT score, and will be explained this clearly defines the wound characteristics. If a wound has many characteristics, wound is then rated according to the most predominate feature on the photograph. Scores are added together to make a total sum. Total scores range from 0 to 32, where a decreasing total score indicate healing.

The collected data was entered and analysed in "SPSS" version-23.0. Variable with quantitative nature like age was presented as Mean±S.D. Variables in qualitative nature like gender was presented as frequencies and percentages. Comparison of two groups' hydrogel and papaya was done with the help of independent sample t-test. The level of significance was set as ≤0.05.

**RESULTS**

Histogram shows age distribution of all patients included in this study. In Group P mean age of patients was 52.98±8.90 and in Group H was 50.98±9.62. In Group P the age of patients rages in between 30- 70 years while in Group H it was 26 and 65 years respectively. In this study 63 (55.3%) patients were male and 51 (44.7%) were female patients. In Group P, 34 (59.6%) patients were male and 23(40.4%) were female. While in Group H 29(50.9%) patients were male and 28(49.1%) were female patients. Mean PWAT score in Group P and in Group H patients was 5.09±1.65 and 6.02±1.78. Patients in Group H had significantly higher PWAST score as that of Group P patients. i.e.

p-value=0.005. Box plot shows PWAST score in both treatment groups. Patients in Group P had higher PWAST score as that of Group H patients.

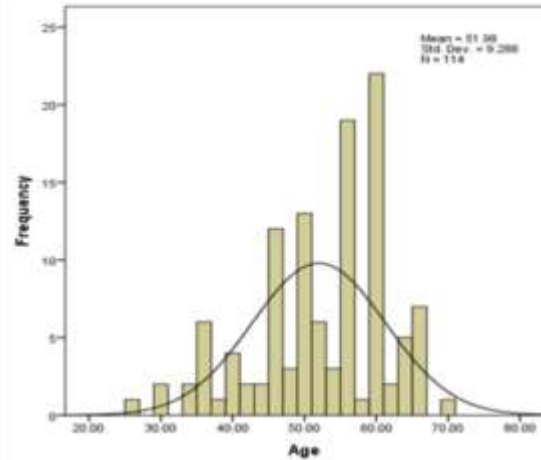


Figure-1: Age of patients

Table-1: Descriptive statistics for PWAT Score in Treatment Groups

	Group H Hydrogel Dressing	Group P Papaya Dressing
N	57	57
Mean	6.02	5.09
SD	1.78	1.65
p-value	0.005	

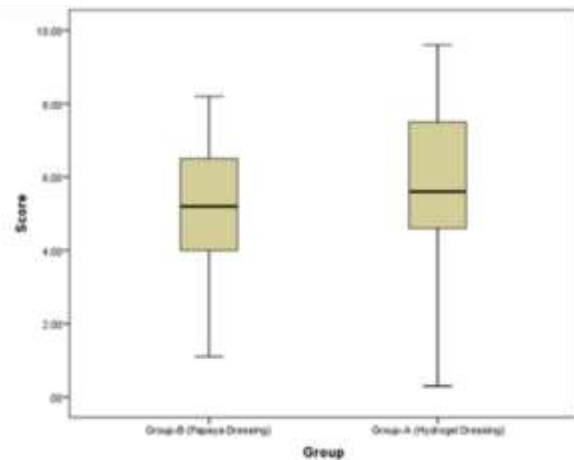


Figure-2: Box Plot for PWAST Score in Treatment Groups

**DISCUSSION**

Diabetic Foot Ulcers behave differently depending on the condition, so, to date there is no ideal dressing for these wounds. It is an accepted fact that the idea behind the development of these dressing is to make a dressing, which will keep the wound moist all the time. Moist environment help the wound in autolytic debridement, enhances granulation, promote angiogenesis and causes speedy movement of epidermal cells over the wound.<sup>13, 14, 15</sup> The dressing should be able to absorb excess exudates in the wound. A variety of dressings are available and are studied to check their effectiveness. But to date, there is no single dressing ideal which has been recommended by the competent authority for the management of these wounds.<sup>13</sup>

Hydrogel dressings have been used since decades for the management of these wounds. These days, many types of hydrogel and non-hydrogel dressings are available, to use in

different types of wound. Many different studies have shown the efficacy of papaya dressings in the management of these wounds.<sup>16-18</sup>

In this study, we compared of hydrogel dressing with papaya dressing in patients with diabetic wounds. We used Wound Assessment tool "PWAT" to compare the efficacy of these two treatment regimes. As per final "PWAT" score hydrogel dressing is more effective as compared to Papaya dressing for diabetic wound healing. i.e. Group P (Papaya dressing): 5.06±1.65 vs. Group H (Hydrogel Dressing): 6.02±1.78, p-value=0.005

Studies have not compared hydrogel dressing with papaya dressing in patients with diabetic wounds. However, both the modalities have been compared with other dressing types for treating diabetic wounds. Different studies have used different criteria for assessment of final outcomes in terms of wound healing.

A 2013 Cochrane review and meta-analysis of three RCTs stated that hydrogel based dressings are more effective in the management of these patients as compared to the conventional dressings.<sup>19</sup> Most recently, in 2017, Jimenez et al. compared CCO to standard care plus hydrogel and also found no difference in the wound size at 6 and 12 weeks.<sup>20</sup>

A recently published systematic review and meta-analysis on clinical efficacy and wellbeing of hydrogel dressing in the management of diabetic foot wound stated the better efficacy of hydrogel dressings as compared to the controls and that the difference was statistically significant (RR = 1.57, 95% CI: 1.13–2.17, P = 0.007).<sup>82</sup> The above mentioned studies have reported the efficacy of hydrogel for treating diabetic wound thus supporting the results of this study and advocating hydrogel dressing as better treatment option as compared to papaya dressing.

In literature no study was found who compared both these two treatment regimes together making this study unique as well as important to decide the ultimate treatment options for diabetic wounds in our clinical setup.

The advantageous effects of hydrogel are due to the moisturizing nature of these dressings in the management of diabetic foot ulcers. This provides a more physiological environment for the healing of wounds. The added advantage for these dressings is that they absorb wound exudates, auto debride the dead and dying tissue and promote granulation. It helps in reducing the amount of fluid collection in between the dressings and wound surface. Besides, it adheres with the wound tightly and evenly, which prevents the wound from harmful external environment and decreases soreness of the wound.<sup>21</sup>

A local study from Pakistan assessed the effectiveness of papaya dressings in the management of Diabetic foot ulcers. Results of this study showed that after the early surgical debridement and dressings 88.4% do not require any further intervention. In 3 patients (7%), further debridement was done and in 2 (4.7%) patients, amputations were done. Healing time ranged from 18 to 29 days. Mean healing duration was 19.23 days with Standard Deviation (SD) of ± 3.624.<sup>22</sup>

An Indian study used papaya dressing for managing chronic ulcer in manner of cost and healing duration and further surgical treatment. The study stated that papaya dressings are associated with most economical management and results in early wound healing.<sup>23</sup>

Vasuki V compared papaya dressing with normal saline soaked dressing in management of diabetic foot ulcers. The favourable results of this study showed that papaya dressings are associated with auto debridement and keeping the wound moist. It helps in further decreasing the healing time and outcome in these patients.<sup>10</sup>

The therapeutic potential of papaya has been studied from a pharmacological perspective in clinical trials. There are two enzymes in green papaya (papain and chymopapain) that have powerful liquefaction characteristics and can disintegrate dead and dying tissue. Gram-positive bacteria are inhibited by extracts of both ripe and unripe papaya fruit, as well as the seeds. Infected

wounds caused by gram-negative bacteria respond well to high doses. The protein-like compound produces the antimicrobial, bacteriostatic, and fungicidal aglycone of gluco-tropaeolin benzyl isothiocyanate (BITC).<sup>24</sup>

## CONCLUSION

Based on result of this study it can be concluded that hydrogel dressing is more effective than papaya dressing for treating diabetic wound. Although papaya dressing also have a beneficial effect on diabetic wound but still its efficacy is less as compared to hydrogel dressing

## REFERENCES

1. Young TJB, JoN. Debridement—is it time to revisit clinical practice? 2011;20(11):S24-S8.
2. Park KJP, Stop, Medicine s. Epidemiology of chronic non-communicable diseases and conditions 2009.
3. Danaei G, Friedman AB, Oza S, Murray CJ, Ezzati MJ, Phm. Diabetes prevalence and diagnosis in US states: analysis of health surveys. 2009;7(1):16.
4. Hakeem R, Fawwad AJ, Jod. Diabetes in Pakistan: epidemiology, determinants and prevention. 2010;1(3):3.
5. Turns MJB, JoCN. The diabetic foot: an overview for community nurses. 2012;17(9):422-33.
6. Driver VR, Fabbri M, Lavery LA, Gibbons GJ, Jovs. The costs of diabetic foot: the economic case for the limb salvage team. 2010;52(3):17S-22S.
7. Fisher TK, Scimeca CL, Bharara M, Mills Sr JL, Armstrong DG, JotAPMA. A stepwise approach for surgical management of diabetic foot infections. 2010;100(5):401-5.
8. Murthy MB, Murthy BK, Bhavne SJ, Jop. Comparison of safety and efficacy of papaya dressing with hydrogen peroxide solution on wound bed preparation in patients with wound gape. 2012;44(6):784.
9. Jones VJT, DF. Use of hydrogels and iodine in diabetic foot lesions. 1999;2(2):47-52.
10. Vasuki V, Thanmaran N, Vimalakaran B, Madan KJ, JSJ. Comparative study of papaya dressing versus normal saline dressing in healing of ulcers. 2017;4(4):1209-16.
11. Rajaram B, Venkanna M, Kumaraswamy B, Kumar DR, Patlolla SR, Maripeddi K, et al. . The role of papaya dressings in the management of diabetic ulcers; a prospective study. . J Evidence Based Med and Healthcare. 2015;2(42):7365-71.
12. A. G. A comparative study of hydrogel dressings versus conventional dressing for treating diabetic foot ulcers—a randomized controlled trial Int J Sci Res. 2018;7(3).
13. Lipsky BA, Berendt AR, Cornia PB, Pile JC, Peters EJ, Armstrong DG, et al. 2012 Infectious Diseases Society of America clinical practice guideline for the diagnosis and treatment of diabetic foot infections. 2012;54(12):e132-e73.
14. Braun L, Kim PJ, Margolis D, Peters EJ, Lavery LA, JWR, Regeneration. What's new in the literature: An update of new research since the original WHS diabetic foot ulcer guidelines in 2006. 2014;22(5):594-604.
15. Bakker K, Apelqvist J, Schaper NC, research IW, GotDFEBJ, Dm, reviews. Practical guidelines on the management and prevention of the diabetic foot 2011. 2012;28:225-31.
16. Das A, Dickerson R, Ghatak PD, Gordillo GM, Chaffee S, Saha A, et al. May dietary supplementation augment respiratory burst in wound-site inflammatory cells? : Mary Ann Liebert, Inc. 140 Huguenot Street, 3rd Floor New Rochelle, NY 10801 USA; 2018.
17. Dickerson R, Banerjee J, Rauckhorst A, Pfeiffer DR, Gordillo GM, Khanna S, et al. Does oral supplementation of a fermented papaya preparation correct respiratory burst function of innate immune cells in type 2 diabetes mellitus patients? : Mary Ann Liebert, Inc. 140 Huguenot Street, 3rd Floor New Rochelle, NY 10801 USA; 2015.
18. Dickerson R, Deshpande B, Gnyawali U, Lynch D, Gordillo GM, Schuster D, et al. Correction of aberrant NADPH oxidase activity in blood-derived mononuclear cells from type II diabetes mellitus patients by a naturally fermented papaya preparation. 2012;17(3):485-91.
19. Dumville JC, O'Meara S, Deshpande S, Speak KJ, CDoSR. Hydrogel dressings for healing diabetic foot ulcers. 2013(7).
20. Jimenez JC, Agnew PS, Mayer P, Clements JR, Caporusso JM, Lange DL, et al. Enzymatic debridement of chronic nonischemic diabetic foot ulcers: results of a randomized, controlled trial. 2017;29(5):133-9.
21. Zhang L, Yin H, Lei X, Lau JN, Yuan M, Wang X, et al. A systematic review and meta-analysis of clinical effectiveness and safety of hydrogel dressings in the management of skin wounds. 2019;7:342.
22. Ch IM, JoRMC. Role of papaya dressings in the management of diabetic foot ulcers. 2014;18(1):87-9.
23. Rabari Yash B, Singh Rakesh B, Prasad DV, c AAA. ROLE OF PAPAYA (CARICA PAPAYA) DRESSINGS IN THE MANAGEMENT OF CHRONIC ULCER. National Journal of Medical and Dental Research. 2016;4(4):329.
24. Hewitt H, Wint Y, Talabere L, Lopez S, Bailey E, Parshad O, et al. The Use of Papaya on Pressure Ulcers: A natural alternative. 2002;102(12):73-7.