Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v31i4.5603

FREQUENCY OF DIABETIC FOOT ULCERS AND ITS IMPACT ON FUNCTIONAL LIMITATION AND PSYCHOLOGICAL WELL-BEING AT SAIDU GROUP OF TEACHING HOSPITAL SWAT

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Abstract:
A diabetic foot ulcer DFU is a skin lesion that affects the epidermis and section of the dermis with presently or formerly diagnosed diabetes mellitus (DM) and is commonly associated with neuropathy. Globally, the prevalence of DFU is 6.3%; it affects the quality of life, limits mobility and physical functions and imposes a substantial psychological impact on a person's life, leading to stress and depression. This study determines the frequency of diabetic foot ulcers and their effects on patient's functional limitations and psychological well-being. Three hundred-one patients were recruited from the Saidu Group of Teaching Hospital. Three questionnaires were used: Wagner Grading Classification, Barthel Index, and Perceived Stress Scale (PSS). Prevalence of DFU was found in 20.3% of patients with DM. Among these, 46% of patients had Grade 1 DFUs, and 21.3% had Grade 2, followed by Grade 5, which was prevalent in 14.7% of patients. 44.26% of males and 34.43% of females had moderate stress levels, whereas 8.20% of males and 1.64% of females reported high-stress levels. Severe functional limitation was seen in 26.23% of males and 8.20% of females, who are severely dependent, whereas 29.51% of males and 21.31% of females were moderately dependent. A positive correlation was found between DFU, perceived stress levels, and functional limitation ($p<.001$). A significant difference was found in the mean square of Barthel index and PSS with DFUs i.e., $F (5, 295) = [1141.118]$, $p<0.001$ and $F (5,295) = [1248.909]$, $p<0.001$ respectively. The study concluded that foot ulcers have a positive correlation with functional limitation and psychological stress and in the current study every 5th DM patient has a DFU, which has directly affected their mental and physical health. Hence the increased severity increases the functional limitations and psychological stress levels.

Keywords: Diabetes Miletus, Diabetic foot ulcer, functional limitations, psychological well-being

Introduction:

A diabetic foot ulcer (DFU) is defined as a full-thickness lesion of skin that is a wound penetrating through the dermis, it is full-thickness wound below the ankle (1,2) Globally the prevalence of (DFU) is 6.3%. (3,4) and, about 9.1 million to 26 million people with diabetes develop foot ulcers (FU) per year(4). Studies from Pakistan have shown DFU prevalence ranges between 4% and 10% and the amputation rate is higher ranging from 21% to 48%(5) . The Notable factors behind the occurrences of DFU are peripheral neuropathy and peripheral vascular disease which is a common condition associated with diabetes (6,7). Nerves are sensitive to increased glucose levels, 66% of patients with diabetes develop, peripheral neuropathy is one of the main reasons behind developing FU (7,8). In diabetic patients, peripheral vascular conditions are caused by occlusion in lower leg vessels which thereby leads to ischemia and tissue death (9).

Diabetes associated with DFU in patients is a considerable aspect behind morbidity and mortality in respective patients. About 70% of patients have an amputation and these patients after amputations have a mortality rate ranging between 39 to 80% (10,11). DFU affects one daily chores and activities and affects one social life (12). The presence of DFU along with diabetes deteriorates psychological and mental health, leading to further complications such as amputation (13). It imposes a huge psychological impact on life, patients with diabetes along with DFU have anxiety have health-related quality of life affected (14,15)

In follow-up study conducted by Ali Mekonen Adem et al concluded that nephropathy, retinopathy, and body mass index (BMI) were found to be significant predictors of DFU. The hazard of DFU is increased by 13% with high BMI, and 5.56 and 2.37% with retinopathy and nephropathy respectively (4). Sana A. AlSadrah et al. recorded results that shows the HRQOL score among the subjects that didn't develop DFU had better life quality than those subjects that suffered DFU (16). Marjolein M Iversen and colleagues in their study observed that patients with diabetes and DFU had significantly low scores of psychological well-being, anxiety and depression (13).

The effects of functional limitations and psychological well-being did not receive enough attention regarding its significance in foot ulcers. As per the author's knowledge, there is less literature available about diabetic foot ulcers and its impacts on functional limitation and psychological well-being of patients in Pakistan. This study aims to determine the frequency of diabetic foot ulcers and its impact on functional limitation and psychological well-being in patients attending Saidu Group of Teaching Hospital Swat.

Methodology:

In tertiary care teaching hospital of Saidu Group of Teaching Hospital Swat (SGTH), cross sectional study was conducted. Sample size of 301 was generated using Openepi with 95% of confidence interval and 95% of margin error. Inclusion criteria for study was participants diagnosed with type 2 Diabetes Mellitus (DM) and neuropathy age of patients >35 years old. Individual diagnosed with Soft tissue infection, polio, amputated, myositis, cardiovascular diseases CVDs, foot condition like hammer toe and bunion, peripheral arterial diseases PADs, neurological conditions such as multiple sclerosis and transvers myelitis were excluded from this study. After approval from study from Graduate Committee (GC) of IPM&R,KMU and MD of Saidu Group of Teaching Hospital data was collected from patient referred to physical therapy department after diagnosed with peripheral neuropathy. After the consent form was taken by patients, foot ulcer assessments as done using "foot Ulcer classification for grading and staging". Barthel Index Scale was sued for evaluation of activities of daily life (ADLs) and perceived scale for psychological stress and mental health. The data was examined using SPSS version 25. Descriptive analysis was used for socio-demographic data and to find frequency of diabetic foot ulcers and pearson correlation was calculated. One-way ANOVA was performed to compare the effects of three different scales used to determine the DFU grades, its phycological impacts and functional limitations

Results:

Demographics and Characteristics:

Table 1Gender distribution

Gender Distribution					
Gender		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	171	56.8	56.8	56.8
	female	130	43.2	43.2	100.0
	Total	301	100.0	100.0	

Table 1 shows percentage and frequency of gender distribution of total sample size. Total sample size of the study was 301out of which 171 (56.8%) were males and 130 (43.2%) were females. Table 2 shows that 61 individuals had diabetic foot ulcers making total percentage of 20.3% whereas other 240 individuals 79.7% reported no DFUs

Table 2 Prevalence of Diabetic Foot Ulcer

Prevalence of DFU					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	61	20.3	20.3	20.3
	No	240	79.7	79.7	100.0
	Total	301	100.0	100.0	

Table (3) given below is frequency distribution of age among both the gender, i.e., diabetic males and females. The age group in which least patients reported diabetes was 35-40, making only 5% (15 patients) of total percentage. Highest frequency i.e., 50% (151) were found in age group of 46-55 followed by age group of 56-65 where 30.6 % (92) reported diabetes. While in age group of 66 and above only 14.3% (43) patients were Diabetic.

Table 3 Age distribution of Diabetic Foot Ulcer

Age					
Age Group		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	35-45	15	5.0	5.0	5.0
	46-55	151	50.2	50.2	55.1
	56-65	92	30.6	30.6	85.7
	66-75 and above	43	14.3	14.3	100.0
	Total	301	100.0	100.0	

According to the gender distribution bar chart given below (figure 1), 12.96% males and only 7.31% females reported having diabetic foot ulcers summing to 20.27%, while 43.85% males and 35.88% females out of total sample have diabetes but did not have DFU, making total of 79.73%.

Figure 1 Diabetic Foot Ulcer Prevalence in males and female

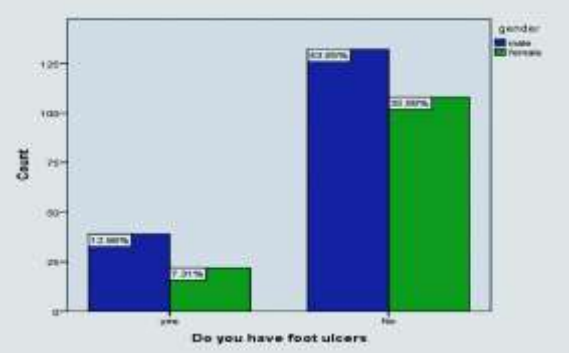

Table 4 Frequency of grading of DFU

Frequency of Grading of DFU				
Grading of foot ulcer		**gender**		
		Male % (n)	Female % (n)	**Total (n)**
Grade 1	% within Grading of foot ulcer	50.0% (14)	50.0 % (14)	28
Grade 2	% within Grading of foot ulcer	84.6% (11)	15.4% (2)	13
Grade 3	% within Grading of foot ulcer	60.0% (3)	40.0% (2)	5
Grade 4	% within Grading of foot ulcer	66.7% (4)	33.3% (2)	6
Grade 5	% within Grading of foot ulcer	77.8% (7)	22.2% (2)	9
Total	% within Grading of foot ulcer	63.9% (39)	36.1% (22)	61

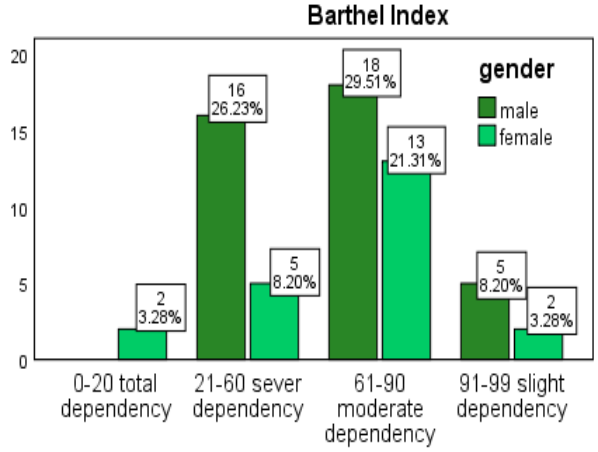

Figure 2 Functional Limitation according to Barthel Index Score among Diabetic Foot Ulcer patients

Figure 2 shows the functional limitation among DFU patients according to Barthel Index score. Only 3.26% (2) females are totally dependent among all DFU males and females. However, 26.23% (16) males and 8.20% (5) females are severely dependent. The highest number of patients of both genders are found in moderately dependent category i.e., 29.51% (18) males and 21.31% (13) females. The least frequency is seen in slightly dependent category i.e., 8.20% (5) males and 3.28% (2) females.

Table 5Pearson Correlations

Correlations				
		Grading of foot ulcer	Barthel Index cut off score	PSS cut off score
Grading of foot ulcer	Pearson Correlation	1	.768**	.934**
	Sig. (1-tailed)		.000	.000
Barthel Index cut off score	Pearson Correlation	.768**	1	.874**
	Sig. (1-tailed)	.000		.000
PSS cut off score	Pearson Correlation	.934**	.874**	1
	Sig. (1-tailed)	.000	.000	
**. Correlation is significant at the 0.01 level (1-tailed).				

Table 5 shows correlations between the three scales used in this current study that is, DFU Wagner classification, Perceived Stress Scale PSS and Barthel index. The correlation coefficient (r) equals to 0.768 and 0.934 for Barthel index and PSS respectively, indicating strong positive relationship between perceiv that the coefficient has st

Table 6 ANOVA statistics for Barthel Index score and Diabetic Foot *Ulcer Gradings*

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Barthel Index cut off score	Between Groups	272.780	5	54.556	1141.118	.000
	Within Groups	14.104	295	.048		
	Total	286.884	300			

Table 7ANOVA statistics for PSS and Diabetic Foot Ulcer Gradings

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
PSS cut off score	Between Groups	201.231	5	40.246	1248.909	.000
	Within Groups	9.506	295	.032		
	Total	210.738	300			

Table 6 One-Way ANOVA revealed that, there is statistically significant difference in mean square of DFU grading and Barthel index i.e., F (5, 295) = [1141.118], $p<0.001$. Similarly, the above table 7, shows that mean square of DFU grading and PSS are statistically significantly different i.e., F (5,295) = [1248.909], $p<0.001$.

Discussion:

This study consisted of a total 301 diabetes mellites (DM) patients, and all were type-2 diabetes patients out of these 61 patients were diagnosed with DFU, making total prevalence of 20%. In Pakistan, different study reported about the prevalence of DFU. This study resembles to figures mentioned in "The Diabetic Foot Worldwide". It reported a 26.3 % prevalence of DFU in Pakistan (17). Other studies conducted in Sudan By Ahmed O et.al in 2017 reported nearly the same prevalence is i.e. 18.1% (18) and 13.9 % according to a study conducted by Amanullah Khan et.al (18) among type 2 diabetic patients and 15% for overall diabetic patients (19). On the contrary, a study conducted in Lahore, Pakistan reported a prevalence of 7.2% incidence of DFU(20), A potentially reason for this could be that the study conducted in Lahore included outdoor patients whereas this current study included indoor or admitted patients. Similarly, a study conducted in India contradicts the prevalence rate of the current study. In India about 51.8% reported having DFU (21). With increasing the population and diabetes incidents the estimated prevalence of DFU is likewise increasing.

According to this study, the age between 46-65 has a higher prevalence of DFU. These statistics are supported by the study of Amanullah khan et al. conducted in Pakistan and the mean age stated by them was 53.82±9.96 years (22). The frequency of DFU among males was higher i.e., 63% than females 39%. Ahmed O and his collogues stated similar results in a study conducted in Sudan i.e., high prevalence among males i.e., 58.7% than females 41.3% . The opposing results to this study were by S. P. Vibha et a. that showed a higher frequency of DFU among females than males i.e. 57.4% (23). The majority of the population was Hindu, other factors that contribute to the risk of developing Foot ulcers, are demographics, culture lifestyles, and environmental and psychological factors have a role in developing DFU. These factors can be the potential reason for the difference in prevalence.

The frequency of the Wagner grading classification system has many varieties depending upon the cause of DFU, grading proficiency, pathogens, and the hygiene of the patient. In this study grade 1 has the highest frequency followed by grade 2, grade 4, and at last grade 3 and 5. Similarly, the most frequent grades 1 and 2 were reported in a study of Dan Kuang et al. conducted in China (24). A study by Priti Shah conducted in India showed that the highest frequency of grade 2 followed by 3, 4, and then grade 1 (19), whereas Jamil Ahmed and his collogues reported the highest frequency of grade 3, then grade 4 followed by grade 2 and (25). Emad Aborajooh et.al in their study stated that grade 1 and grade 2 frequency is highest among patients having neuropathy, retinopathy, and diabetic duration

of more than 20 years whereas smokers and the anemic patient had a high frequency of grade 3 or more (26). So, the convincible reason for different frequencies in grading can be due to other comorbidities, smoking habits, cause of DFU, obesity, diabetes type and duration, and hygiene and care of the wound.

According to the author's knowledge and previous literature, most of the studies have evaluated the quality of life among DFU patients and have linked poor quality of life among DFU due to physical and psychological infirmity, but none study has used a perceived stress scale. Many studies have related the poor quality of life among DFU to physical inability, limited physical activities, poor mental health, and stress and anxiety(13,27–29). This study shows that a high percentage of DFU patients reported moderate dependency i.e., 29.5% males and 21% females, followed by severe dependency 26% males and 8.2% females. The results resemble a study conducted by Pedras S in 2018, which verified that about 81.7 % of DFU patients show dependency, and few show complete functional dependency. While reporting overall functional limitation, 18.3% showed independence, 62.4% were mild dependent, 14.9% showed sever independency and 4.5% were totally dependent for activities of daily life (30).

Psychological well-being among DFU patients in previous studies is reported to be compromised. In this study, 44.26% of males and 34.4% had a moderate level of stress whereas 8.2% of males and 1.6% of females had high level of stress. Likewise, Ahmedani MY et.al. mentioned about 50.4% of DFU patients had depression on the scale of the patient health questionnaire and they scored less than 9 (29). Similarly, Mohammad Jabbar M. et.al. concluded that psychological well-being among Diabetic foot patients in Al-Najaf Hospital was deprived, using the hospital anxiety and depression and the scores were 26% mild, 37.5% moderate, and 20% severe (31).

Physical function is one of the variables used to evaluate quality of life. J.W.G. Meijer et al conducted a cross-sectional patient control study in which different scales including the Barthel index were used to evaluate the physical well-being of DFU. The study group scored 19.2 points (SD 1.5) while the control group scored 19.8 (SD 0.5) which is not significant. However, it also states reverently and significantly lower QoL among the study group. Perhaps the study has used more than one standard scale to evaluate QoL, including RAND-36 and Walking and Walking Stairs Questionnaire WSQ which evaluates more than one parameter of health and QoL (32)

According to the results of this study, positive correlation was found between functional limitations and psychological stress related to DFU. p-value is less than 0.001 for both Barthel Index score and PSS scale and r values were 0.768, 0.934, and 0.874 for Barthel index, Perceived Stress scale and Wagner classification respectively. A study conducted by Susana Pedras in Portugal found a positive correlation in mental and physical components with DFU and stated similar results to this study i.e., $p<0.001$ and the r values were r=.498 and 606 respectively (33). However, study of Iversen MM showed lower score of depression with history of foot ulcer i.e., HADS ≥ 8 and reported lack of association between depression and DFU (13). Possible reason for the difference can the that Iversen MM et.al conducted retrospective survey where patients who had DFU in the past were included (13). According to the authors knowledge and search, previous studies did not use Barthel index and psychological stress scale, instead many studies have evaluated physical and mental component scores using RAND-36 questionnaire. Susana Pedras and colleagues in their study found a positive relation between foot ulcers and mental and physical components (53). Surprisingly, this is the first study that has evaluated the relationship between functional limitation and stress among DFU patients. Other studies (16,27,32) have used the SF-36 questionnaire and reported the relationship of poor quality of life with DFU.

Conclusion:

This study concluded that foot ulcers have a strong positive correlation with functional limitations and psychological stress which means that increase in the severity of Diabetic foot ulcers has an increase potential to cause severe functional limitations and psychological stress levels. Moreover, in the current study every 5th Diabetes mellites patient has DFU, which directly affects their mental and

physical health. Hence the increased severity increases the functional limitations and psychological stress levels.

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